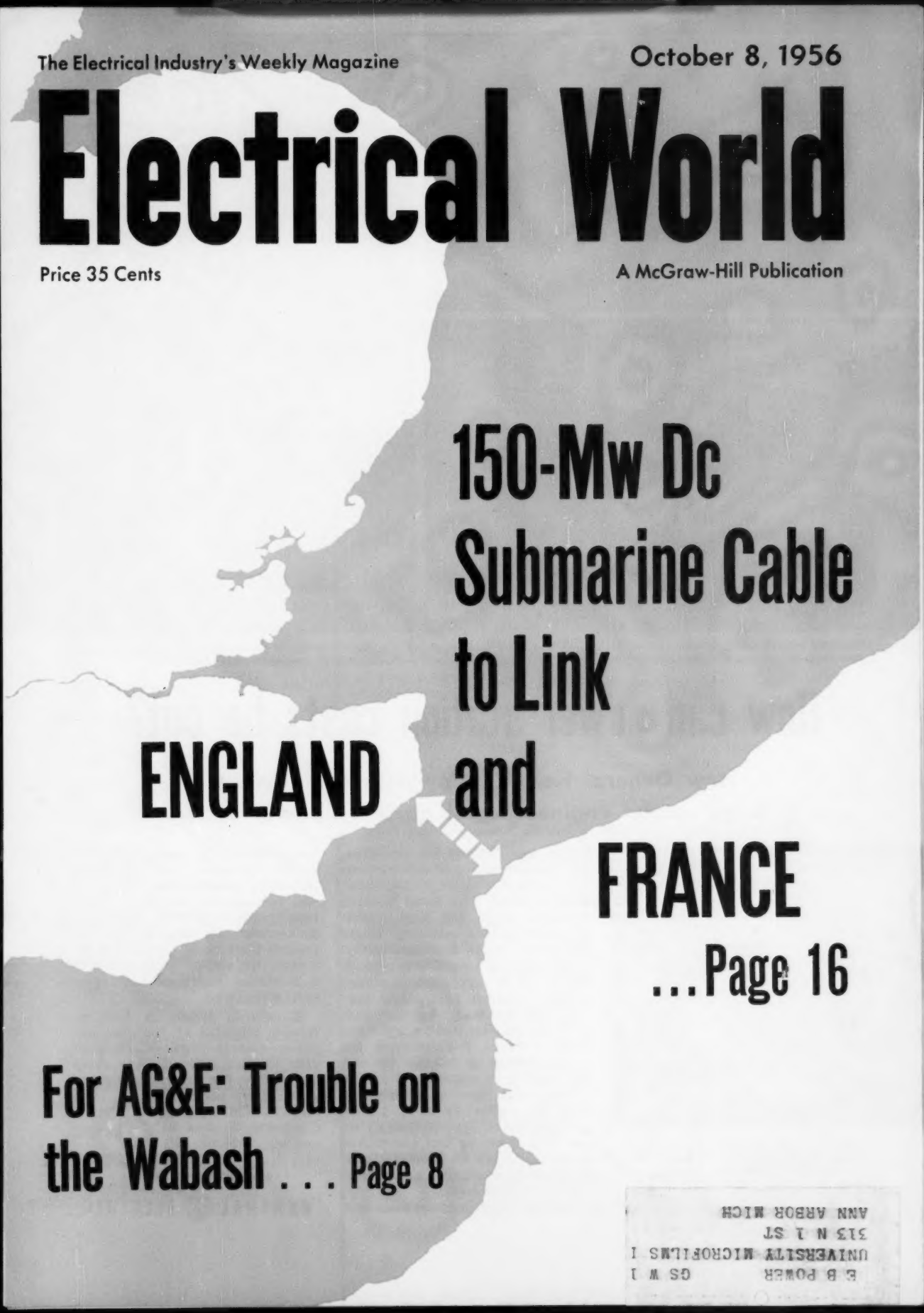
The Electrical Industry's Weekly Magazine

October 8, 1956

# Electrical World

Price 35 Cents

A McGraw-Hill Publication



## 150-Mw Dc Submarine Cable to Link ENGLAND and FRANCE

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## For AG&E: Trouble on the Wabash . . . Page 8

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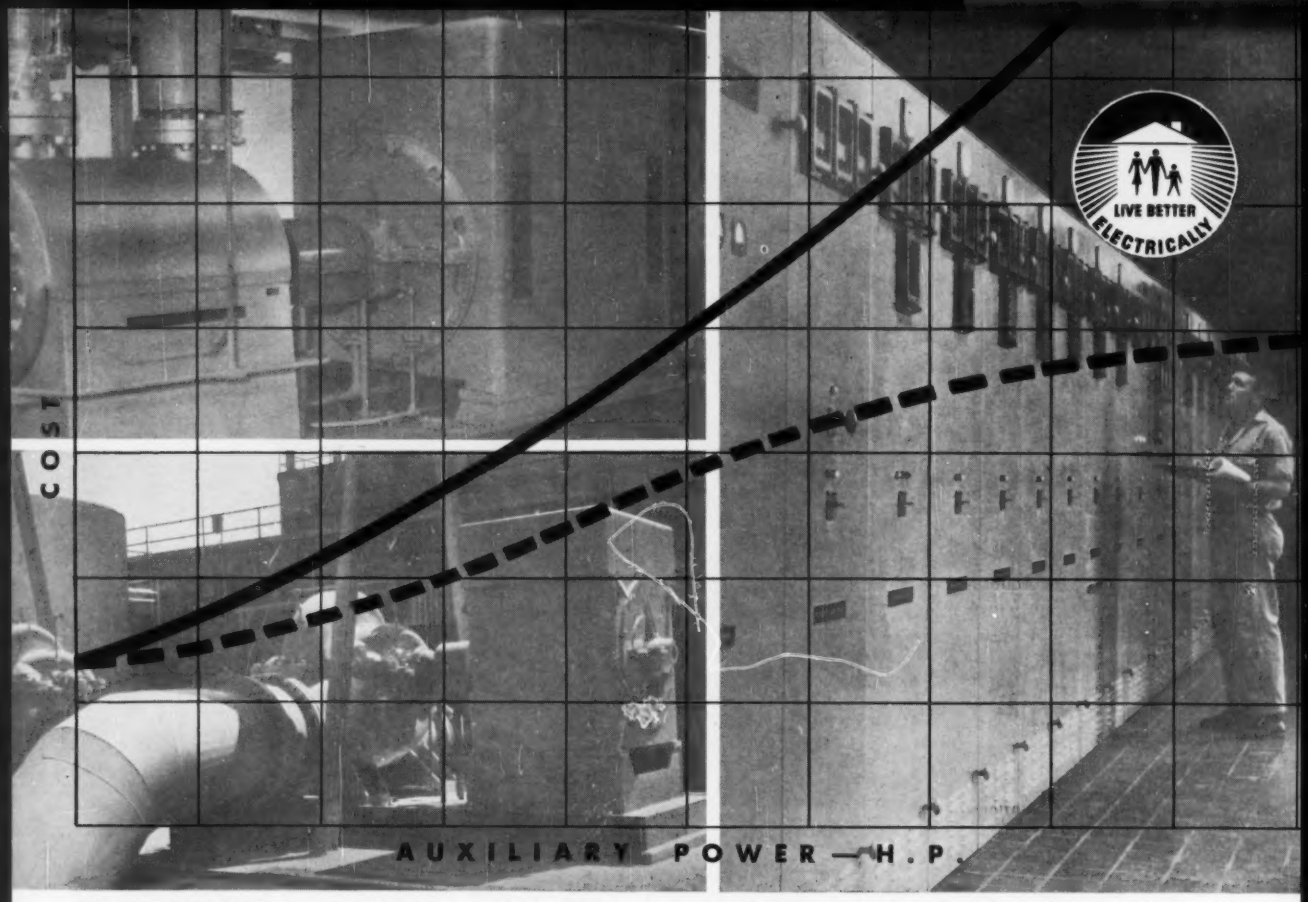
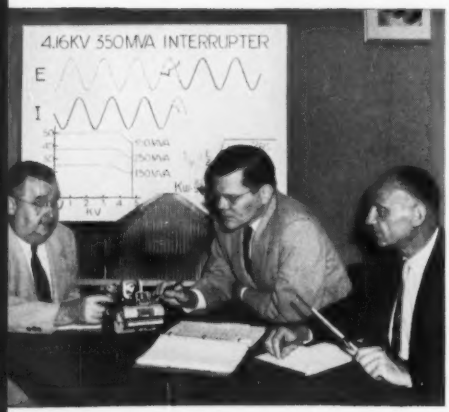



**AUXILIARY POWER COSTS** can be reduced by re-evaluating present system design with an eye to future expansion needs. Solid line indicates extension of a present method of system design. G-E study shows substantial savings possible by proposed method (dotted line).

# How can power station costs be cut?

## New General Electric study points to savings through careful engineering of auxiliary power systems




**4.16-KV, 350-MVA SWITCHGEAR** will serve large auxiliary power systems of the future. Above, engineering mgrs. G. M. Reed, E. M. Troischt, and J. G. Torbit, G.E.'s Medium Voltage Switchgear Dept., study design of interrupter components for new high-capacity, metal-clad, magne-blast equipment.

Units over 500,000-kw, operating at super-critical steam conditions are probable within the next several years. The trend towards increased unit size and higher pressures means auxiliary power requirements will increase rapidly.

A recent General Electric study based on an all-electric auxiliary system indicates that major savings can be made by thorough planning of the plant's auxiliary power system. For instance, for units as large as 200,000 kw and up, auxiliary system voltage is shown to be most economical at 4.16 kv rather than at higher voltages—even if it requires the use of as many as four buses. Another possibility for economic gain is offered by using split low-voltage winding transformers.

An additional cut in costs can be achieved by using selective motor throwover and paralleled throwover schemes for emergency and routine bus transfers, rather than transferring 100% motor load as is sometimes the practice. This proposed method of operation increases the size of units to which a particular rating of switchgear can be applied.

To obtain details on how intensive planning of the auxiliary power system pays off, contact your General Electric Apparatus Sales Office. For a copy of the study on auxiliary power systems, write for GET-2673, General Electric Company, Section 301-290, Schenectady 5, N. Y.

*MORE POWER TO AMERICA*

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**ELECTRICAL WORLD**

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial and Advertising Offices. **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y.

Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Executive Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

**Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.**

**Subscriptions are solicited only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.**

Single copies 35¢. For the United States and possessions and Canada, $6 a year, $9 for two years, $12 for three years. Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries, $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter at the Post Office at Albany, N. Y. Printed in USA. Copyright 1956 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

# Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or supplying electric power

**Vol. 146 No. 15** **October 8, 1956**

## TRANSMISSION

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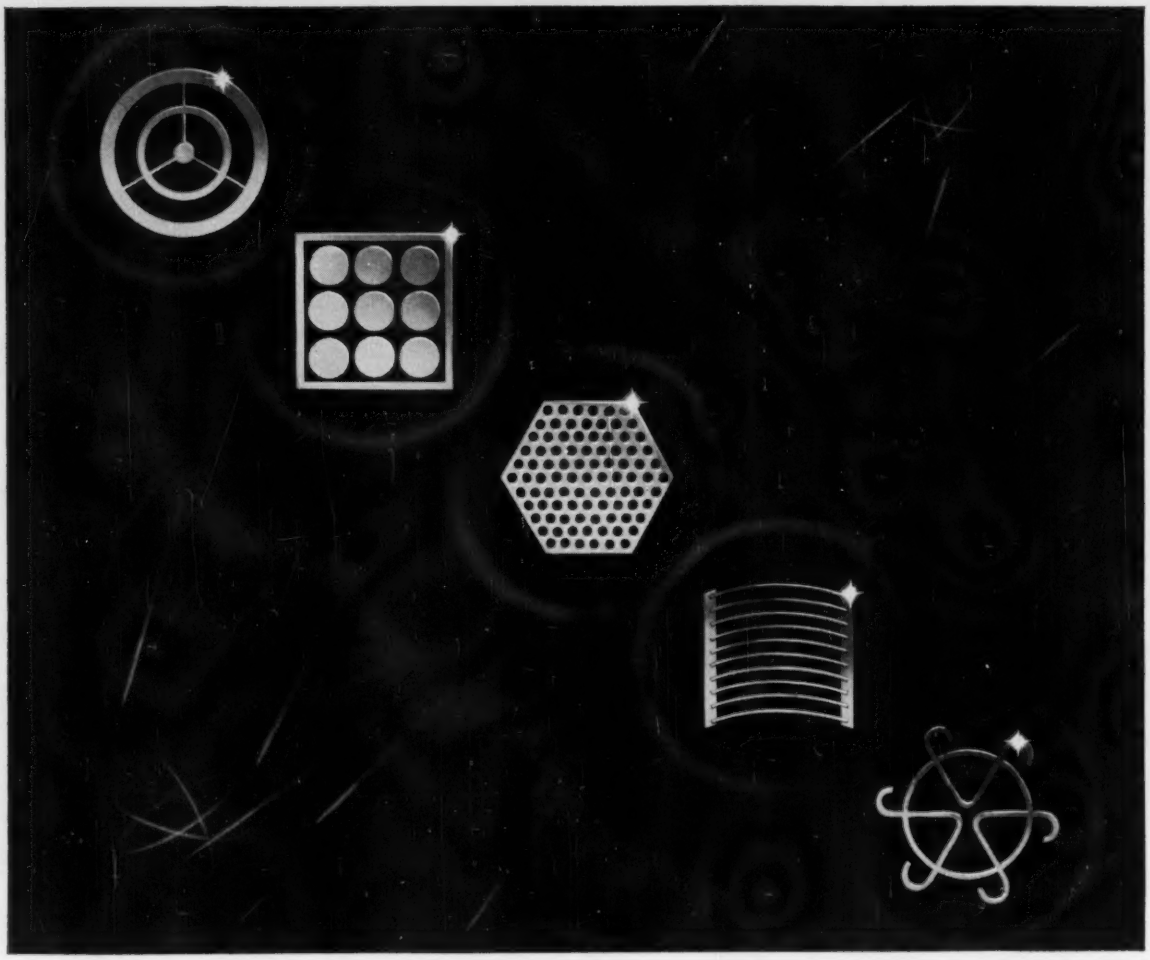
***COMING NEXT WEEK—The question, "What are the characteristics of modern power stations?" will be answered in EW's Fourth Steam Station Design Study. Sixty-seven stations erected in the last two years will be covered.***



# SHAPE UP...

## for nuclear power

The efficiency of power production from nuclear reactors depends a great deal upon the design, composition, and construction of the fuel element itself. Shape, size, mechanical structure and degree of enrichment all play a part in the extraction of maximum energy with minimum fuel cost.

Finally, the *reprocessing* of irradiated fuel elements has an important bearing on the unit cost of nuclear power. This is a task that requires expert knowledge and specialized equipment and, in general, is an outside service that will be required by reactor operators.

With more than eight years of successful experience in solving advanced technical problems in atomic energy, Sylvania has long been a leading processor of reactor fuel elements and assemblies, as well as a pioneer in the development of fuel elements and reprocessing techniques. Whether your reactor plans are immediate or for the future . . . for power or research . . . international or domestic . . . our scientific and engineering staff will gladly discuss your problems with you. For your files, write for Sylvania's just-published booklet on Nuclear Fuels.

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# EDITORIALS

## Can European Practices Extend Cable Art?

American scientists and engineers, charged with responsibility for redoubling electrical supply systems in this country, are finding in Europe today ideas that stimulate and inspire their traditional Yankee ingenuity. For European scientists, under pressures inspired by postwar recovery, are striking out in directions not unlike our own to develop electrical systems capable of powering resurgent industry.

Much of the work going on in the electrical laboratories and test stations of Europe is directly related to development work in progress or contemplated here. Obvious parallels are found in the areas of extra high voltage transmission, bundled conductor techniques, radio influence measurement and control, pneumatic and oil-poor circuit breaker designs, pantograph switch mechanisms, and many others.

In the area of cable research and development, the similarities and differences are particularly worth noting. In Europe cables operating at 230 kv are to be found near several cities. In America pipe cable for this voltage has been built and installed, and research on cables of even higher voltage is going forward. Both here and abroad there is great interest in plastics for low voltage cables. But here we are apparently ahead of Europe in applying rubber compounds. Americans watch with keen interest the extrusion of aluminum and new antimony-lead cable sheaths now undergoing development in Europe. These and other aspects of cable progress abroad are analyzed in this issue (page 26) by an eminent American cable engineer, recently returned from a tour of cable facilities in England, France, Germany, and Italy.

Dc transmission too is enjoying a revival in Europe as a result of two years' successful operation of the 20-Mw, 100-kv link between Sweden and Gotland. Russia reports five years' operation of a 30-Mw, 200-kv link. Apparently convinced of its feasibility, the British and French last month disclosed their mutual intention of providing a 150-Mw, 200-kv dc submarine cable link across the Straits of Dover. Although the suitability of dc transmission for U. S. systems has been questioned, the independence of such a link from voltage and frequency differences makes it economically and technically attractive for tying the British and French ac systems. These considerations are spelled out in this issue (page 16) by a recognized British spokesman for dc.

Not all the aspects of European dc transmission or cable developments will prove attractive or even applicable to American systems. But European research facilities and manpower may provide a convenient soil for germinating ideas to be subsequently adapted to the cable systems of American electric utilities.

## A Kw's a Kw for Turbine Generators

Turbine-generator rating is now clearly defined by the name plate. It is the kw output of the generator when the turbine is operated at rated steam (and reheat) pressure and temperature with full extraction from all extraction points, exhaust pressure of 3.5 in. mercury, and feedwater makeup of 3%. The generator must be able to put this power on the line at 0.85 pf with hydrogen at the rated pressure.

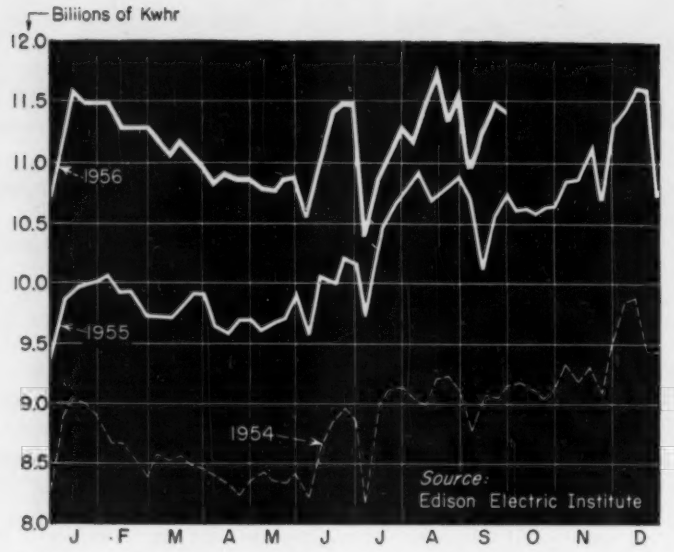
The electrical industry has been gravitating toward standardization in turbine-generator ratings. This evolution was traced in EW, Sept. 24, p. 45. Ratings assigned on this basis are the same as those sought by EW for its long series of annual steam station surveys. And a variable which confused the per-kw cost of generating plants by almost 40% only a few years ago (EW, July 12, 1954, p 83) has been cut to relative insignificance.

Variables still remain in methods of driving exciters and feed pumps. And bolder operators will continue to eke out more kw by ferreting out manufacturing tolerances and by operating units under conditions more favorable than those contemplated by the maximum guaranteed turbine capability. But today's rating practice, for most practical purposes, gives a clearer, more accurate measure of turbine-generator capabilities.

**Don't Fail to Vote**

# ELECTRICAL WEEK

**LAST MINUTE**




## OUTPUT

**Week ended Sept. 29**
**11,365,000,000 Kwhr**
**Up 6.9%**

**Atomic Energy Commission requirements—1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 6.4%**

Per Cent Change From Previous Year

| | Total US | New Eng. | Mid. Atlan. | Cent. Ind. | West Cent. | South-east | South Cent. | Rocky Mount. | Pacific NW | Pacific SW |
|---|---|---|---|---|---|---|---|---|---|---|
| Sept. 29 | +6.9 | +7.9 | +5.5 | +7.7 | +8.1 | +5.5 | +6.9 | +9.4 | +5.2 | +8.8 |
| Sept. 22 | +6.7 | +7.2 | +4.3 | +7.1 | +5.6 | +5.1 | +11.8 | +8.7 | +6.9 | +9.0 |
| Sept. 15 | +6.7 | +8.9 | +6.3 | +8.8 | +7.2 | +5.1 | +7.0 | +7.4 | +3.6 | +5.8 |

Seasonally Adjusted Index 218.2 Week Ago 219.8 Year Ago 203.7

**Here are the issue's highlights** . . . Public Service Co of Indiana petitions SEC to determine whether AG&E will violate Holding Company Act by building new steam plant on Wabash . . . Hydro turbine makers protest imports . . . Automated industries hate voltage dips, engineers hear . . . North Carolina co-ops say they get better wholesale power rates by threatening to build their own generating and transmission facilities . . . What caused Toledo Edison's system to black out? Experts still don't know . . . Niagara Mohawk's 25-cycle power rates may make "ghost town" out of resort . . . Westinghouse spurs research . . . Where Europe stands in the cable art.

**Plans to increase Niagara Falls power potential develop on two fronts** as Niagara Mohawk seeks FPC authority to rehabilitate Section 3A of its destroyed Schoellkopf station to provide 104,000 kw. Meanwhile N. Y. State Power Authority Chairman Robert Moses, confident of support from the area's leading industries, prepares a plea to Gov Averell Harriman for advance money from State Emergency Capital Construction Fund for state development at Niagara.

**Pres Eisenhower and Adlai Stevenson will tackle power conscious Northwest** next week for power policy bout in one of the year's most important political battlegrounds. Ike is seen to go to aid of Washington's Gov Arthur B. Langlie, now trying to unseat Sen Warren G. Magnuson, and of Douglas McKay, former Interior Secretary, who vies with Sen Wayne Morse in Oregon's senatorial race.

**AEC authorizes contract negotiations for a 12,500-kw nuclear power project** proposed by Piqua, Ohio. Under Piqua's proposal, AEC would retain title to the reactor and Piqua would furnish land, buildings, and conventional electrical equipment. The reactor, using circulating organic fluid (Terphenyl) as moderator and coolant and slightly enriched uranium as fuel, would be built and designed by North American Aviation.

## NEWS OF THE INDUSTRY BRIEFLY TOLD

**Washington Wire . . . Power revenues from federal power operations** under Southeastern and Southwestern Power Administrations, "as in previous years, are not sufficient to cover the costs of producing electric energy and to amortize the government's investment applicable to power," discloses U. S. Comptroller General Joseph Campbell. Two auditing reports just issued find that SEPA was $3.4 million and SWPA $5.4 million in the red for 1955.

**SEC's report of second quarter sales and profits** for industry shows electrical machinery industry sales were up 8% to $4.5 billion from first quarter but net profit was down 21%. However, total figures for first half showed 15% increase in sales and 5% increase in profits over year ago.

**AIEE pays triple tribute** to Dr Charles F. Kettering, Dr F. E. Terman, and Nikola Tesla at Fall General Meeting. First annual Kettering Medal is awarded to the noted inventor, and Terman, provost and dean of engineering at Stanford University, gets AIEE's first member-for-life medal. Tesla's centenary celebration is highlighted by Dr S. G. Hibben's demonstration lecture outlining the inventor's contributions.

**Okonite Co,** United Rubber Workers-CIO, and state and federal mediators agree to new one-year contract with a 9¢ an hr wage boost which company offered originally, plus extra holiday. URW had asked for 12¢ an hr hike. Estimated loss of income for an average employee for the 8-day strike was at least $140—equivalent to 7¢ per hr on base pay for one year.

**Arrangements for linking Pacific Northwest Power Pool** and public and private power systems of Colorado, Wyoming, and Western Nebraska have been completed. Effective Oct. 15, the tie at Billings, Mont., would add one million kw to the 7.5-million kw pool of PNP now in operation.

**Westinghouse Electric Corp announces 5% price increase** in its steam and gas turbine products. The increase, effective immediately, was made to "offset increased costs of steel and other materials as well as increased labor costs," said a steam division spokesman.

## ABOUT PEOPLE IN THE INDUSTRY

**If Congress believes that an accelerated nuclear power development** program is in the public interest, private utilities have no right to complain, **Willis Gale, Chairman, Commonwealth Edison Co,** told the Atomic Industrial Forum. "If, however, the acceleration is accomplished in a way which favors public power over private power, then we should be concerned and we do have a right to complain," he said.

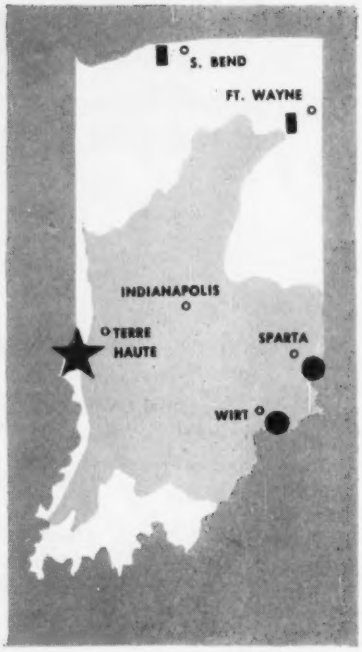
**Rep Sterling Cole (R, N. Y.),** ranking minority member of the Joint Congressional Committee on Atomic Energy, told utility executives at PEA meeting in Pittsburgh: "It is your duty to study the national atomic energy program, to take into account our international obligations . . . to examine the technical problems . . . and determine how your resources and talents can be best applied."

**More News About People page 39**

# Indiana PS Says to AG&E: "Stay Out!"

**Public Service of Indiana petitions SEC to determine whether AG&E violates Holding Company Act in building large new generating plant on Wabash River in PS area**

**Sporn calls petition "complete surprise", says there's no intention of expanding his service territory**




Public Service Co of Indiana has called on the Securities and Exchange Commission to help settle a dispute with a sister utility company—Indiana & Michigan Electric, a subsidiary of American Gas & Electric Co.

What irks Indiana PS is the site selected for Indiana-Michigan's proposed 450-Mw Breed plant on the Wabash River about 20 miles south of Terre Haute. That's well within Public Service's territory. Furthermore, Public Service contends that lines linking the plant with other American Gas & Electric facilities near Wirt, Sparta, Fort Wayne, and South Bend (see cut) will carry 330 kv transmission lines throughout its service territory (represented by shaded area on cut.) In all, Public Service figures these lines will encompass about 17,500 square miles of territory not now in the AG&E system.

Whether or not AG&E intends to render service in this new area, says PS, the construction "would place AG&E in a position to render or seek to render service which would only compete with that provided by existing utilities serving the public of the area and force the curtailment of their own normal expansion as needed."

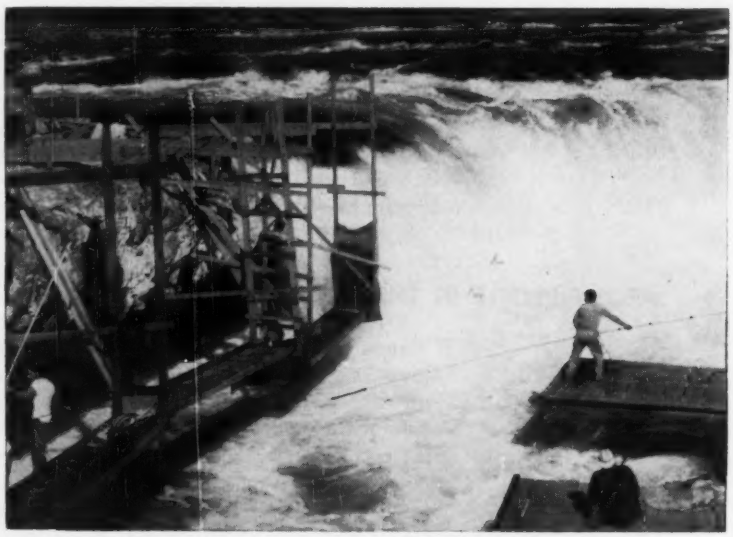
Thus, Public Service asked SEC to determine whether AG&E would continue to constitute a legally integrated public utility system under the Holding Company Act if it or one of its subsidiaries proceeds with the proposed plant and transmission lines.

Philip Sporn, president of both AG&E and Indiana-Michigan, said he was "completely surprised" at the action taken by Public Service. "It seems to me to be based on a complete misinterpretation of the plans announced and the program being carried out by Indiana & Michigan.

"What we are doing here," said Sporn, "is no different from what we have done elsewhere on the American Gas & Electric System and what has been done by all progressive utility organizations to accomplish this objective: develop a plant site having combined in it, in an optimum manner, the over-all factors of site location, particularly the availability of water for condensing purposes and an economical, long-term fuel supply."

"Specifically, this program does not involve or contemplate, either in the present or in the future, any expansion of the service area of Indiana & Michigan," Sporn said.

Later in the week Indiana Public Service Commission told SEC that the dispute should be handled by the state commission, not a federal body.



## Power for Northwest is Red Man's Loss

Transformation from an Indian salmon fishing site to dam reservoir will take place soon at Celilo Falls on the Columbia River in Oregon, upon completion of Dalles Dam, located downstream. One-half of the dam's hydro-electric power will be used by an aluminum plant to be built in the area.

Indians (above), plying their long-handled nets from platforms over the falls, have been paid for the loss of their fishing rights, which by a government treaty, were to last forever.

# Hydro Turbine Makers Protest U.S. Imports

**NEMA's Hydraulic Turbine Section says security and defense of nation depends on hydro power. Urges government to buy American-made units to keep industry intact**

United States manufacturers of hydraulic turbines may be compared to artisans of a by-gone era who plied their crafts with polished, costly skills. Like the artisans, the turbine industry turns out relatively few units, having high labor content, for sale in extremely limited markets. Today these manufacturers are in trouble.

Through the Hydraulic Turbine Section of the National Electric Manufacturers Assn, these turbine makers are protesting the increasing encroachment of foreign manufacturers into the limited U. S. market.

### ODM's Help Called For

In an 18-page statement to the Inter-Agency Committee on Hydraulic Turbines, Office of Defense Mobilization, the NEMA group implores that a policy be established that would direct the federal government to buy water turbines made at home.

Part of the trouble can be traced to the standard of living in the United States, where the American worker earns hourly 2½ times the skilled Swiss worker's pay, 3 times that of the Austrian or British worker, 4 times that of the Belgian, Frenchman, German, and Dutchman, and 12 times that of the Italian.

Part of the trouble can be traced to the "custom" nature of the industry, for each turbine must be tailored to its own installation. This prevents the U. S. turbine industry from capitalizing upon virtues of mass production.

Foreign manufacturers, the statement says, can pay transportation costs and import duties, yet still underbid American manufacturers from 30 to 50% "at will." America just can't compete with that.

But in a country where the economy is built upon brisk competition—in a country that believes the lowest bidder should get the job—isn't the NEMA recommendation a bit of an enigma?

No, asserts the statement. The very security of the United States rests in part upon the turbine industry's shoulders, for dams are big, inviting targets for enemy bombers. And what will the U. S. do if its big dams get the blockbuster treatment accorded European and Korean hydroplants during the past two wars? Who will repair the damage if there is no hydro-turbine industry with its accumulated know-how?

In this age of competitive regulation, there are no holds barred. Foreign manufacturers should be stopped from bidding on American projects, and the foreign orders should be diverted into America's ledgers. To back this, the statement quotes from the "New York Times:"

"There is no case on record during the last 50 years, apart from countries entering customs unions, where a European country has permitted an invasion of its domestic market for a manufactured product comparable to that occurring recently in the American bicycle trade. Had any such thing started to occur, nobody would consider it in the least unusual for the country to drive the competing import out by any means at its disposal."

So the NEMA group sees its request as being fair to all in accordance with currently accepted world-wide rules of the economic game.

The turbine makers particularly are worried about recent federal grants to foreign competitors. Reason: The government buys by far the most hydraulic turbines. With its export market already having dwindled from $3.8 million in 1946 to $0.3 million in 1955, the industry cannot hope to survive the loss of 50 to 70% of its last remaining (domestic) market, the statement says.

American money has helped the war-torn European and Japanese nations to regain their strong pre-war footing, the statement says, and now this is hurting American turbine makers. The time has come for the American government to look after its own industry. A basic, long-range policy is needed, the statement says.

The industry is too vulnerable to federal procurement policies to survive piecemeal determination of its future.

# Virginia Dam Plan Challenged

Feasibility of a proposed $45-million federal dam and power plant on the Rappahannock River in Virginia was challenged and defended last week at a public hearing in Washington before the Board of Engineers for Rivers and Harbors.

Friends and foes of the Salem Church project presented their views on proposed enlargement of a multipurpose development of the site. R. M. Hutcheson, system manager for power of Virginia Electric & Power Co, presented studies that cast doubt on the economic feasibility of the flood-control and power proposal.

But field reports from the Corps of Engineers concur in a finding of feasibility based on a benefit-cost ratio of 1.11:1. Re-evaluation of the benefit-cost figures in Hutcheson's statement, however, results in an unfavorable ratio of 0.873:1.

The Salem Church project has been controversial since coming before Congress after World War II. It was originally proposed by Army Engineers as a 240-ft power pool, but valley residents protested successfully against flooding of rich bottomland by the reservoir. Congress later compromised and authorized a 220-ft power pool. At that time (1946) Army Engineers found the 220-ft plan economical. But subsequent rising costs emphasize economies that can be obtained with a large project.

A 240-ft plan has been proposed again. The House passed the measure, but the Senate asked Army Engineers to study the proposal. The favorable interim report subsequently submitted is now under consideration.

Raising the maximum power pool to 240 ft for the Salem Church site would increase installed power capacity from 66,000 kw to 102,000 kw, and dependable capacity from 39,000 kw to 64,000 kw, according to the report. Total usable power storage goes up from 330,000 acre-ft to 620,000 acre-ft.

# Automated Industry Hates Voltage Dips

Service quality for electrical supply to industrial, commercial, and residential customers was accented in the first Westinghouse Distribution Engineering Conference at East Pittsburgh and Sharon, Pa., recently. Representatives of 35 utilities joined Westinghouse engineers in the week-long program.

Voltage dips, long a problem to distribution engineers, were reported particularly troublesome to automated industry by B. L. Lloyd because contactors drop out after a few cycles of low voltage. Solution is sometimes found, he said, in latched-in relays and contactors, regulating transformers, and M-G sets. But utilities must demonstrate what voltage variations can be expected and manufacturers must design equipment to ride through. Lloyd predicted revision of industry standards on control equipment as part of the ultimate solution.

Engineering knowledge today enables utility designers to provide satisfactory supply for arc furnaces. Their problem is mainly one of economy, Lloyd said. And harmonic problems from rectifiers respond to simple and inexpensive correctives.

Shopping centers have unusually desirable load characteristics and merit careful consideration of supply capacity, voltage, economy, and service reliability, said W. H. Ferguson. Small centers can be served adequately by single radial distribution, but large ones may justify network supply. Where less than half the load comprises 120 or 208-v devices, system cost can be cut with 265/460-v service.

The higher secondary voltage was demonstrated by T. J. Bliss to achieve substantial economies in large commercial buildings, particularly where it eliminates excessively heavy risers or upper-floor transformer vaults. Secondaries at 265/460 v or 240/480 v were urged by H. E. Lokay for economical overhead service to tomorrow's heavily-electrified homes. And the same voltages offer best possibility for economy in underground residential distribution systems, said J. M. Claytor.

# N.C. Co-ops Study Generation

A number of North Carolina's 32 electric cooperatives have launched a study to determine the possibility of building their own generating and transmission facilities. Their aim is to improve their bargaining position with wholesale power suppliers.

This was disclosed by Alton Wall, president of the 17-member North Carolina Electric Membership Corp in an address before the American Institute of Cooperation.

In his talk on "How an electric cooperative can better its bargaining position with respect to its wholesale power supply," Wall said co-ops and others have been receiving more favorable rates by threatening to build such facilities.

He claimed that "it was only after the 17 co-ops" had formed Eastern North Carolina Electric Membership Corp and "had engineers prepare preliminary plans for building of a generation and transmission system were they able to obtain wholesale power contracts without restrictive clauses from Carolina Power & Light Co and Virginia Electric Power Co at 7½ mills per kwhr and from the old Tide Water Power Co (later bought out by CP&L) for 8½ mills per kwhr."

A Carolina Power & Light Co spokesman, however, said these same rates were charged to other customers, including the 15 non-member co-ops.

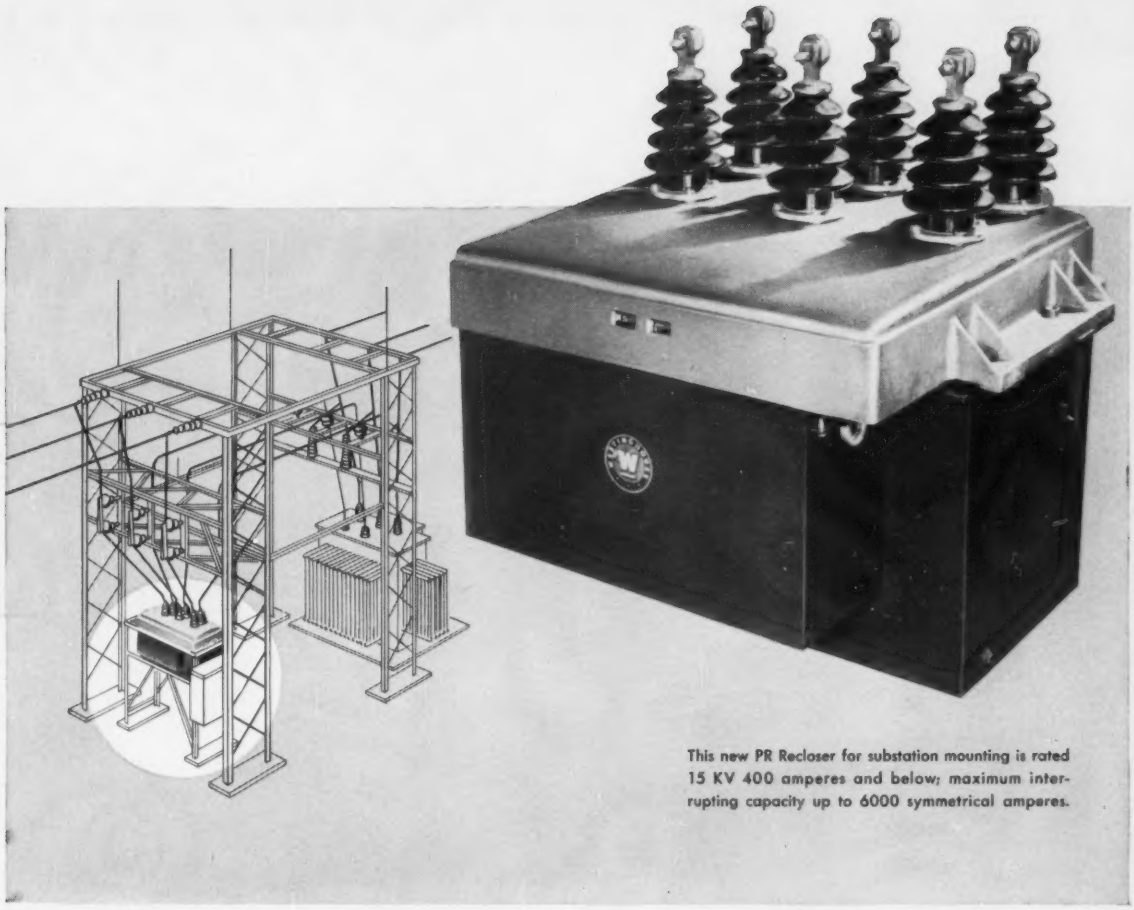
Wall, who is also manager of Randolph Electric Membership Corp, said that tremendous power neeeds of the future dictated this study by a federation of cooperatives.

## Russia Gives Atom Plant Model to U.N.

A model of the first atomic power plant of the U.S.S.R., now at United Nations Headquarters in New York, is examined by Omar Loufti of Egypt and Russia's Georgy F. Saskin, representative and acting permanent representative, respectively, to the U.N. The model was presented to the World Assembly as a gift of the Soviet government.

### Correction

R. B. Brown Jr, illuminating engineer with Boston Edison Co, was incorrectly identified as R. B. Jones in the cutline appearing in the Oct. 1 edition of EW, p 53. Electrical World regrets the error.



This new PR Recloser for substation mounting is rated 15 KV 400 amperes and below; maximum interrupting capacity up to 6000 symmetrical amperes.

# NEW automatic recloser

## . . . inexpensive protection for growing substation loads

Here's a packaged bargain for your distribution system in the substation or out on the line.

First of all, the new PR recloser provides 2-3 cycle, high-speed opening, and fast, efficient power restoration. This means, too, much greater protection than ever before against line burn-down. It's all completely automatic . . . real assurance of service continuity on your system.

Second, the package unit is especially built for reduced installation and operating costs . . . shipped frame mounted, wired, tested, ready to be put on the line.

Third, many circuit breaker features are built into the new PR recloser . . . proved condenser bushings, multi-ratio bushing current transformers for ground trip and load indicating metering and other relay functions, dependable motor reclosing, in addition to the time-proved Westinghouse De-ion® interrupters.

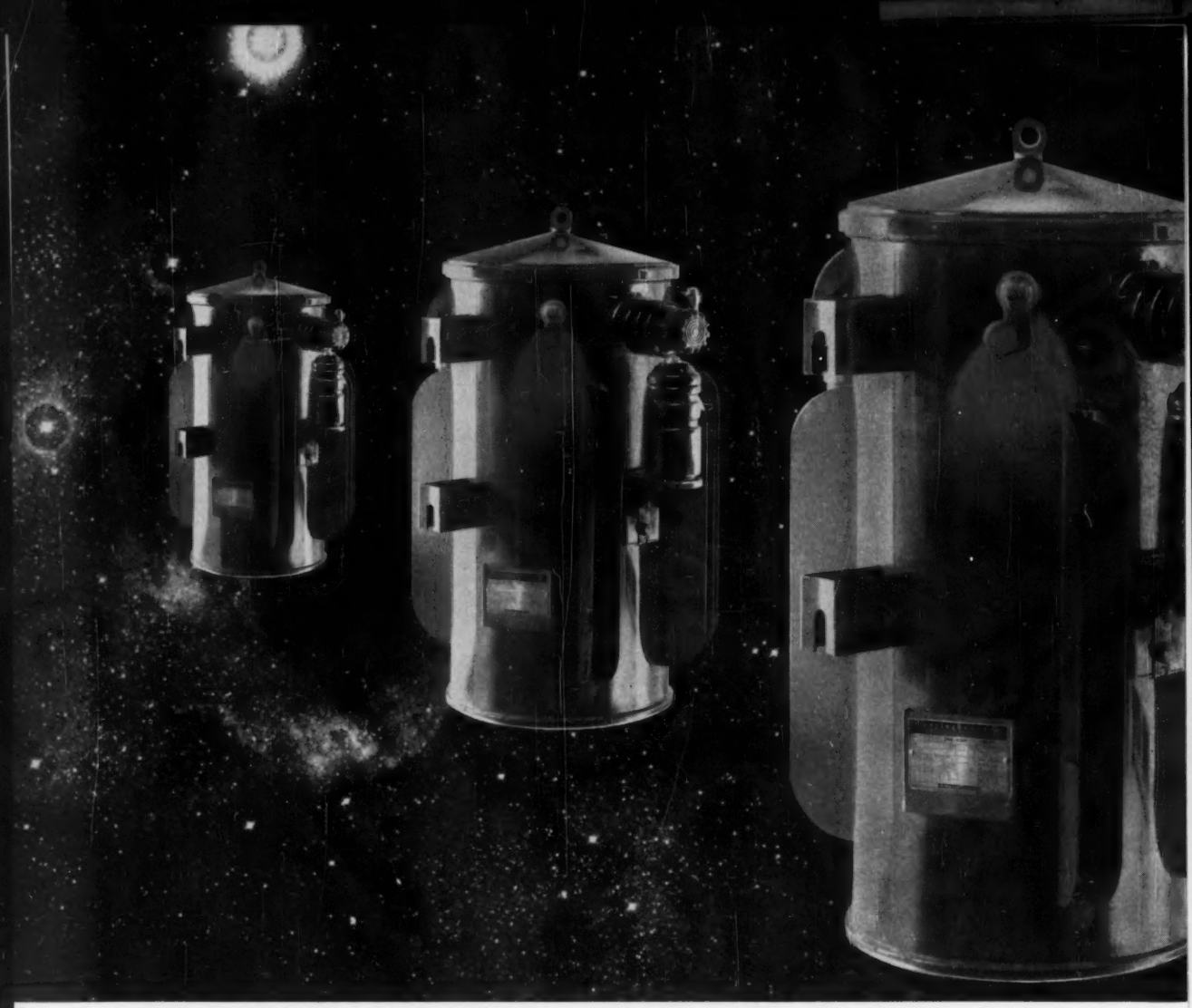
Fourth, to ease operating chores, the Westinghouse recloser design provides two separate tanks . . . one, an oil tank, housing the interrupters; the other, a relay and mechanism tank. No scrambling in oil tank with recloser control devices . . . a tank lifter offers easy oil and contact inspection. An accessory cabinet is available with ammeters, control protection and switches . . . demand meters separately trough mounted provide means of load indication and integration.

There's more to the story, so call your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

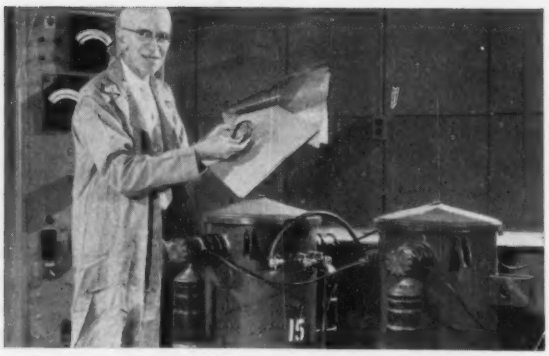
J-60890

**WATCH WESTINGHOUSE!**

*WHERE **BIG** THINGS ARE HAPPENING **TODAY!***



# The transformer that



"You can't test transformer life by just testing insulation," says A. M. Lockie, design engineer, who has developed the unique, new concept of functional life testing of distribution transformers at Westinghouse. For full description, see Lockie's AIEE papers, *Functional Life Expectancy Tests for Liquid-Filled Transformers* (55-520 and 53-243).

**ACCELERATED LIFE-TESTS-TO-DESTRUCTION PROVE 20% INCREASED OVERLOAD CAPACITY OF WESTINGHOUSE TRANSFORMERS SAVE UTILITIES OPERATING DOLLARS**

The new Westinghouse transformers already have a lifetime of success behind them. How is that possible? Through a revolutionary new concept of proving performance . . . a new concept in determining transformer life. This means that the new Westinghouse Type S and CSP® transformers have demonstrated in advance a phenomenal life expectancy in service.

Normal breaker settings on Westinghouse CSP transformers have been increased 20% — an additional 15% in the emergency range. The functional tests have demonstrated that this major increase in load capability has been achieved without sacrifice in normal life expectancy...an exclusive Westinghouse development.

What is behind Westinghouse functional life testing? Even more than three years . . . today's life-testing procedures are based on experience obtained from subjecting transformers to 2200 overloads, 30 short circuits at 15 times rated current, a series of impulse, dielectric and induced potential tests, and daily load cycles up to 450% of rating. Only Westinghouse can offer you a transformer with a pre-tested life.

# lived 30 years in 3...

Proof? Here is proof never before applied to a distribution transformer. Complete transformers — not insulation alone, or subassemblies — but complete units have been put through repeated cycles of overload up to 350% of rated load. These tests were conducted under conditions representative of actual service. Aging was accelerated 10 times; 30 years of "normal" life were packed into three. Without a single failure, these transformers also survived periodic impulse, short-circuit and low-frequency dielectric tests.

And check-on-check proof . . . 10,412 Westinghouse transformers have operated successfully up to three years at the higher operating levels on distribution lines of three utilities in New York, Missouri and Texas. In 1954, 1955, 1956, these transformers lived through not only tough load cycles but also severe heat storms — and still delivered a caliber of service never equaled in a transformer.

The result? Reliability of Westinghouse transformer ratings has been conclusively established. This is "functional life testing" at Westinghouse. By giving a few transformers a short and rugged life test, Westinghouse can assure you that the many you buy will have a long and predictable life . . . give you long and dependable service. Specify Westinghouse.

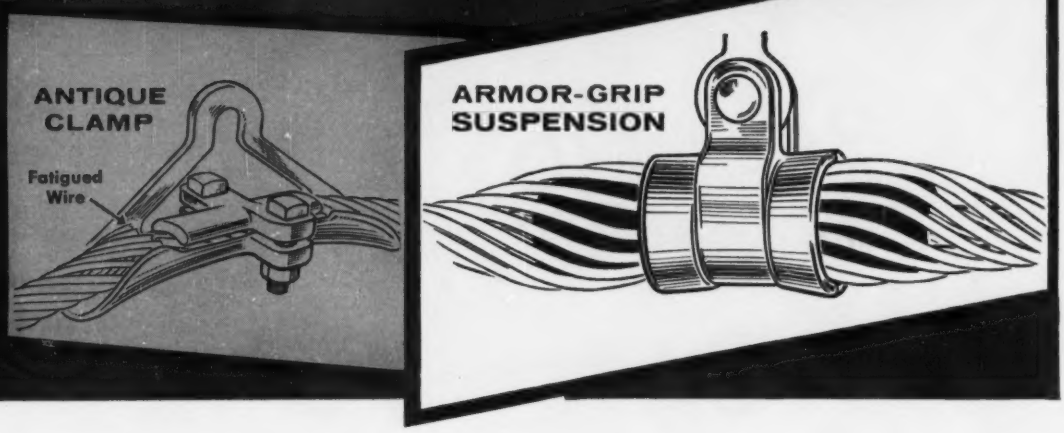
Call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-70777

***WATCH WESTINGHOUSE!***

*COVER THE PRESIDENTIAL CAMPAIGN*

*ON CBS TELEVISION AND RADIO!*

# "PERFECTING not PERFECTION is our goal" *




## "they both suspend the conductor, BUT . . ."

. . . **yesterday's answers** are not good enough. Today's will need improving tomorrow.

Take the problem of vibration fatigue. Failure of strand because of vibration or galloping does not occur in mid span. But it becomes a real problem at points of stress concentration, such as the end of the clamp keeper—at mass concentrations, such as at clamps, dampers and rigid splices—or at wearing points at loose attachments or fastenings.

**Yesterday's answer**—Preformed Armor Rods, introduced by Preformed Line Products Company in 1947.

**Today's answer**—PLP Preformed Armor with pitch direction the same as conductor strand and pitch length less than that of strand (Patent No. 2,609,653). When used in conventional clamps:

- it extends uninterrupted conductor life
- it eliminates wear possibilities
- it prevents excessive mass and stress concentrations

**Tomorrow's answer** is here today: the Preformed armor rod principle carried one step further in Preformed's ARMOR-GRIP SUSPENSION (Patent No. 2,722,393), the entirely new concept in suspension design.

The Armor-Grip Suspension Unit is a "floating suspension"—the conductor is cradled in neoprene and firmly gripped only by the custom-designed Preformed Rods which distribute their pressure over a relatively large area. The result: no wear possibilities—no mass concentrations—*and no clamping stress concentrations.*

This is another example of PLP research laboratories at work. Ever improving methods, materials and solutions is our goal. Call a PLP Representative today and ask for a demonstration.

* *John Dewey, "The Reconstruction of Philosophy"*

*Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.*

PLP

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXPRESS 1-3377

## Artistry in Bone

Archaeologists have found what may be the oldest continuously inhabited area of the world at Wakemap Mound 90 miles east of Portland, Ore. The scientists are working furiously to complete excavations before the area is flooded in March by the reservoir of Dalles Dam, now being completed on the Columbia River.

The original inhabitants are believed to have been Asiatic Indians, and current inhabitants their direct descendants. B. Robert Butler, University of Washington archaeologist, said hundreds of fine carvings in stone and bone have been recovered. "The same artistry done in marble would rival that of Greece and Rome," he said.

## More Power from Germanium

A direct water-cooled germanium power rectifier has been developed. It requires less floor space and, by virtue of its cooling system, has a longer life, R. E. Wahl, General Electric Co, told the American Institute of Electrical Engineers. Some transformerless units have almost 10 kw output a cubic foot of space occupied, and up to 60 kw a square foot of floor space required.

## Ghost Town, Eastern Style

Niagara Falls City Councilman Anthony C. Sabatine says the lure of lower power rates may woo industries away from his town—just as the lure of gold made ghost towns out of some Western outposts. Since the rockslide, which wiped out Niagara Mohawk Power Corp's Schoellkopf plant, Niagara Falls industries have had to pay higher-than-normal rates for 25-cycle power, he points out.

The Basic Industries Power Committee, representing 13 of the utility's biggest 25-cycle customers, currently is negotiating with the utility on the rate boost. The committee's aim: A "livable" rate. Some industries have said that, otherwise, they may be forced to "reappraise" local operations.

## Blessed by Site

Champions of public and of private power in the TVA area are at it again. In a recent editorial entitled "Private Power Needs Public Power, Too," the "Louisville Courier Journal," long-time public power backer, contended that private companies operating near TVA areas "have achieved a higher rate of expansion and profit than the national utility industry average," and yet their rates "are appreciably lower than the national average. . . ." A measuring stick, it asserts, is needed "to measure the fairness of all utility rates. . . ."

Countering this attack, private power advocates point out that private steam plants close to the huge coal fields of Kentucky, Southern Indiana, Southern Illinois, and East Tennessee are blessed by their sites. Paying lower rail and river barge freight rates, they naturally can produce and sell power cheaper than plants farther from the coal fields, which must pay the high hauling rates.

## Obstacles to Spawning

Salmon are important fish in the Cowlitz River, as attested by a petition filed with the Washington State Supreme Court. The petition asks that the City of Tacoma be found in contempt of court for blasting and bulldozing rock into the river at the site of a proposed dam. The complaints were lodged by the state fish and game departments on grounds that the rocks narrow the river channel and make it more difficult for salmon to reach their spawning grounds.

The Thurston County Superior Court earlier had found the project illegal, but allowed preliminary construction to continue on condition that nothing was to be done to the riverbed itself.

## A Legal Squeeze . . .

Jackson (Tenn.) Electric Department says it seems to be "in the middle of a legal squeeze." The Regional Planning Commission has asked it not to serve unapproved area subdivisions. But to adopt such a policy might lay the department open for civil suits from individual customers.

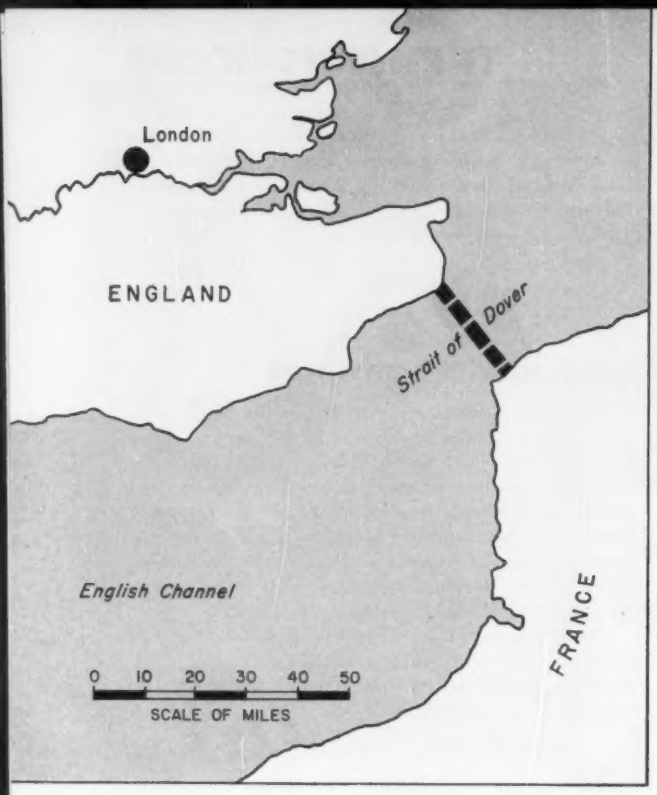
The planning commission made the request in an attempt to squelch "wildcat subdividing" within its five-mile jurisdiction. It pointed to the law which specifies utilities must cooperate with the planning commission, but which fails to provide punitive recourse if the utility refuses.

Hamp Meeks, Electric Department manager, said this would make the department an enforcement agency. Other members of the board called for enforcement of planning regulations before utilities are involved.

The effort to stop unapproved subdividing is aimed at reducing risk that home owners may now be taking when buying property "that might not materialize" because of conflicts with the city's master plan.

## Cost of Taxpayer at Work

E. C. Olander filed suit against Grant County (Wash.) PUD to save $500,000 by making the PUD buy English Electric turbines for its Priest Rapids project (EW, Oct. 1, p 58). Now the PUD reveals that construction delay caused by this suit would have cost $6 million, and a power loss of $14 million. English Electric will keep the turbine order. Earlier the PUD had switched its order from English Electric to an American firm.




# England-France

- Single high-voltage cable (200 kv) replaces ac, multi-conductor link in Anglo-French plans for interconnecting systems
- Sweden-Gotland and Russian underground cables validate use of dc principle
- French hydro overspill energy can conserve British coal; France-to-Britain exchange at British peak will be reversed during that network's off-peak period
- Dc link solves frequency control problem arising from integration of huge systems
- Each to be spared building of peak plant —Swedish terminal items to be adapted

**J. H. M. SYKES**, Editor, *Direct Current*, Member, CIGRE DC Study Committee, Bedford, England

A high-voltage, 150-Mw, dc single cable will link the British supply network with Continental Europe's under the 24-mile-wide Straits of Dover. By 1960 Great Britain and France expect to be swapping power as it is needed in each country.

The recent announcement in London and Paris that this trans-channel project will go ahead implies that high-voltage dc is now considered to have proved itself in practice. The 20-Mw, 100-kv link between Sweden and Gotland, 62 miles out in the Baltic Sea, has operated satisfactorily for longer than two years. The only two cable faults experienced were caused by ships' anchors.

### Russian Underground Cable DC

In the USSR, a high-voltage dc line has operated for nearly five years between Kashira and Moscow, transmitting 30 Mw at 200 kv on two underground cables. Russia is planning more dc projects.

Accordingly, the Anglo-French cross-channel cable will operate at 200-kv dc, using a single insulated conductor. The current will return through a lightly insulated concentric sheath on the outside of the cable, an arrangement for preventing the magnetic effect of the current in the cable affecting compasses of ships using the crowded waterway.

Some cable faults are anticipated. The British Post Office Authorities have found that it was impossible to avoid faults completely on the many telegraph and telephone cables laid across the same general route. Design of the cable, not yet finalized, will permit easy repair on board a cable ship.

The proposed interconnection, under discussion since 1950, constitutes a logical extension of the principle of ever-wider interconnection, applied in British and European utility planning for the past 25 years.

### No Difficulties Insuperable

Great Britain coupled all generating sources with a 132-kv ac network as early as 1930. This National Grid system has operated with conspicuous success and increasing efficiency. France has had interconnections with her neighboring countries since 1950. This interchange of energy has been mutually beneficial and especially helpful in leveling out power deficiencies during droughts and in implementing the employment of overspill energy.

In 1952, the nationalized electricity supply authorities in England and France heard the first report of a joint technical committee appointed to investigate the linking of the two systems by a submarine cable. The committee reported that it had discovered no insuperable difficulties and that the project appeared to have substantial economic advantages. It cited, particularly, the diversity of peak periods between the two systems.

### Frequency Problem Unsolved

Accordingly, a trial length of 132-kv ac connection, partly of British and partly of French manufacture, was laid out from the English coast. For these tests, gas-filled, pre-impregnated, and gas-compression cable types were used. What these tests left in doubt was the problem of frequency control when two large systems are coupled

# Undersea Link to Be 150 Mw Dc

by a cable having a rated capacity of only 100 Mw.

Generating capacity amounted to 17,156 Mw in the British system, and 13,809 Mw in the French. Respective maximum demands were 14,880 and 7,600 Mw. Tests showed that a change of 300 Mw of load or generation in Great Britain would cause a rise or fall in the frequency (nominally 50 cps) of 0.1 cps. A change of 100 Mw would have the same effect in the French system. In Britain frequency control was and is manual in origin; in France a considerable measure of automatic frequency control had been installed at that time and has since been extended.

After the 1952 report extensive frequency control trials over simulated networks, coupled by teleprinter lines between London and Paris, were carried out.

Test reports showed that high-voltage dc power transmission promised advantages, particularly in controlling load flow. But at the time of these findings, experience in the operation of converting equipment was not sufficient to warrant a decision to operate the proposed cable on the high-voltage dc principle.

### Economic Advantages Cited

Economic justification of the international power link lies in the exchange of two types of energy, either separately or together. The French system, with about 50% of hydroelectric plant in its total plant capacity of 16,620 Mw, has a considerable amount of spill energy which cannot be utilized in supplying local loads. The French 225-kv network can carry energy generated by excess water to the dc cable. There this energy can be received on the British 132 and 275-kv Super Grid networks, thus enabling Britain to conserve her hard-pressed coal supplies. The energy could be returned at off-peak periods.

British and French peaks practically always differ by at least an hour. This is due not only to the difference in latitude, affecting the habits of the people. Peak periods vary also because French time in winter is 1 hr ahead of Greenwich Mean Time, but British winter time is the same. The British winter peak, when darkness falls before the industrial load ceases, is at 5 PM. The French peak is at 7:30 AM. In summer both peaks occur around noon, the French an hour earlier than the British.

Thus there is a case for exchanging energy from France to Britain at the time of the British peak, and from Britain to France during British off-peak periods. Marginal differences in generation cost at on-peak and off-peak periods. with different availabilities of hydroelectric energy, show ample economic justification for the exchanges.

### Spares Building Peak Plant

Furthermore, each country at the time of its maximum demand will have available to it from the other country the 150 Mw of power brought in by the cable. Each will be spared the building of 150 Mw of peak plant.

Cost of the cable is estimated at somewhat over $11-million. Cost of power station construction in each country, as of this time, is about $82 to $196 per kw. Thus the two power stations, which the cable could replace, would cost between them about $56-million. There is, therefore, a saving of about $45-million, provided that the cable can be considered as always available. Such considerations may well lead to the rapid establishment of a second cable after the first has been commissioned in 1960.

Use of dc avoids all frequency regulation problems. Two systems, one 20,533 Mw and the other 16,620 Mw, with a synchronous ac link might be compared with two powerful locomotives on a railroad track, running light, and coupled by a piece of string. It would be possible to keep the string unbroken, but the strain on the engineers would be monstrous.

Moreover, the ac link would have required at least three cables, any one of which could have invalidated the usefulness of the other two, were it to become faulty through mechanical damage or for other reasons. Losses on the dc scheme will be limited almost entirely to the ohmic losses in the conductor; whereas with ac the capacitance charging current would be of the order of 2,000 kva per mile.

Cable dielectric can be stressed, with dc, to some 2½ times as great a value in kv per inch as would be practicable with ac. Hence greater use can be made of a given dielectric or, alternatively, a smaller dielectric thickness can be used for a given voltage.

### Mercury Arc Rectifiers Planned

Valves on the rectifier and invertor equipment for the Anglo-French cable project are likely to be of the same Swedish design as those on the Gotland project. The Gotland rectifier unit is made up of two sets of mercury arc rectifiers, each rated 50 kv at 200 amp, joined in series to give 100 kv. It is understood that the channel scheme will duplicate this arrangement, the two sets being connected in series to give 200 kv.

The channel cable project will be the third high-voltage dc power transmission scheme. Others are under active consideration, especially the crossing of the Cook Strait between the North and South Islands of New Zealand where there is an unbalance of hydroelectric power and local load requirement.

### Stories Coming on Other Water Crossings

Stories of two other unusual water crossings will appear soon in Electrical World.

The first (elsewhere in this issue) is the world's fourth longest overhead shore-to-shore link. This is a 10,100-ft triple span over Jervis Inlet in British Columbia built for B.C. Electric Co. It is part of a 100-mile, 132-kv line from Vancouver to Powell River.

The second is of a 2.3-mile submarine cable linking St. Thomas, the largest, and St. John, the smallest of the major Virgin Islands. This cable has been energized at 12.5 kv.

# Ohio Puzzler: Toledo Ed's Blackout

**After big Bay Shore unit tripped, interconnections carried load 11 min, then dropped it, totally disrupting TE's system. Why? There's still no sure answer**

Officials of Toledo Edison Co were still busy last week investigating the chain reaction that knocked down the system for a full 18 minutes on the morning of Sept. 20.

P. R. Knapp, vice president of operations, told a city council committee that the cause of the breakdown is "still in the zone of speculation." He explained that many things occurred almost instantaneously, and there is no conclusive evidence that can establish definitely the cause of the outage.

### Here's How Trouble Started

A service engineer from Westinghouse Electric Corp was making his check of the oil flow system of a Bay Shore Station turbine. The 130,000-kw unit carried one-third of the utility's demand at the time.

At 10:18 AM he turned an oil valve. This action lowered bearing oil pressure until, at 10:22, the automatic shut-off put the machine down.

It is not unusual for a unit to go down during the course of such tests. But the chain of circumstances that followed was highly unusual.

The slack was at first taken up through interconnections with Ohio Edison Co at Sandusky and Ohio Power Co at Fostoria. The intake dropped from 120,000 kw to 45,000 kw. Then, unaccountably, power demand shot up to 95,000 kw. At 10:33, two circuit breakers outside the Toledo system opened. This threw the company's 360,000-kw load onto five generators at its Acme Station. Seconds later, Acme's 275,000 kw went off the line from overload. With the plant off, a 2,500-sq-mi rural, commercial, and residential area was without service.

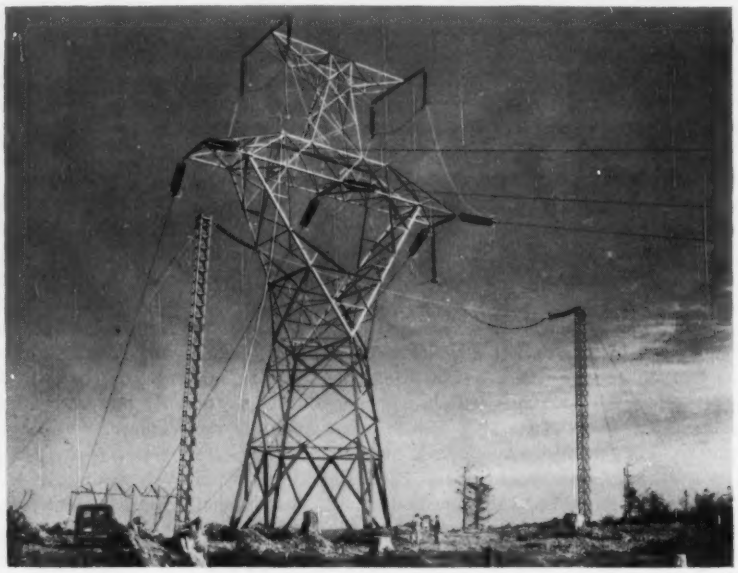
Motorists and pedestrians slowed down before crossing intersections with darkened traffic lights. An elevator serviceman helped three men out of a stalled Commodore Perry Hotel elevator. The principal at Parkland School found a referee's whistle to signal the end of study periods. Sun Oil Co's East Toledo plant belched forth dark excesses of gas from its stacks, causing a fire rumor. Water pressure in the city dropped 20 lb below normal until auxiliary power put one pump back in operation. And Toledo Edison workers vainly checked for major equipment damage.

At 10:51 the orders went out to neighboring power companies to try again. Power surged into the Toledo system without mishap. But the time-consuming job remained of closing some 300 breaker switches in northwestern sections of the state. Instructions for this reactivation were forwarded by radio to men in the field.

By 11:47 service was restored to Toledo's business district. At 1:20 PM the utility's entire system was restored.

Big mystery about the blackout was the cause of the failure of Toledo Edison's interconnection with Ohio Edison and Ohio Power after 11 minutes of trouble-free operation. Power from the tie-ins—enough to handle the inrush from the interconnections—was fed into four large refineries and Libbey-Owens-Ford Glass Co's plant. The fact that circuit breakers opened outside the utility's system brought some speculation that the failure was not caused by Toledo equipment.

Knapp told the city council's public utility committee, "Before (the outage) took place we had every reason to believe that these two interconnections, plus the system's safety measures which had been taken over the years, provided us with ample insurance against such trouble."



## 345-Kv McNary-Ross Line Is Energized

Successful tests on Bonneville Power Administration's McNary Dam-J. D. Ross line paved the way for routine operation at 345-kv design voltage earlier this month. The 175-mi line will carry about 320 Mw from four McNary units to Portland, Ore., load centers.

At four transpositions points (see above), outer phase conductors are joined by a jumper supported on lattice poles. Each phase wire is 1.6-in. ACSR with a 19-strand core of 0.087-in. steel wires covered by 84 strands of 0.145-in. alumium wires in four layers. Lines are suspended on 19 porcelain insulators from steel towers averaging 90 ft.

After clamp is dipped in oil carrying magnetic particles, it is magnetized in Magnaflux coil.

When inspected under "black light", any defects have plainly visible fluorescence.

# TO SEE THE INVISIBLE

## We Use "BLACK LIGHT" to Inspect Hi-Lite Strain Clamps

An important goal of O-B's inspection program is to make sure every Hi-Lite Strain Clamp which you receive will perform within rated strengths. To assure freedom from defects that might impair strength, we use a series of inspection safeguards.

Defects that can be seen are no problem. We catch them on visual inspection checks and by routine checking during manufacture. But what about defects that aren't visible?

To see the invisible, we examine Hi-Lite Clamps under the "black light" — the ultraviolet rays that are part of the Magnaflux-Magnaglo inspection method. Each clamp is dipped in an oil carrying magnetic particles, magnetized and then checked with the "black light." Under "black light", even the smallest defect glows and is plainly visible to the inspector.

But Magnaflux is more than an inspection tool. It's also a method of quality control. We're not content just to find defects. That's just the starting point. We then seek out the causes and eliminate them.

Actually, we find few defects. But according to our reasoning, even one flaw would be too many, if it weren't detected. Magnafluxing of every Hi-Lite Clamp is another good example of Technical Competence in action, working to deliver a completely reliable product.

OHIO BRASS COMPANY • MANSFIELD, OHIO

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4875-II

# Allis-Chalmers . . . for Leadership in

## Philadelphia Electric Company Eddystone Station to Get

# New Dual Cooling

## for 400,000-Kva

# Transformer Bank

### Permits one transformer to carry practically entire load if second unit is out of service

This dual-cooled twin transformer arrangement is believed to be the first of its kind in the world.

Twin 200,000-kva Allis-Chalmers power transformers are to be used with a cross-compound steam turbine. Under normal conditions they will jointly take the full load.

Half the *Electro-Cooler* units provided will serve each transformer. But if one transformer is removed from the line and power is switched to one unit, all *Electro-Coolers* will remove heat from the one active transformer.

With the trend to higher kva ratings in transformers, use of twin units will simplify transportation, handling and installation. And single-phase reliability can be provided in three-phase equipment.

* * *

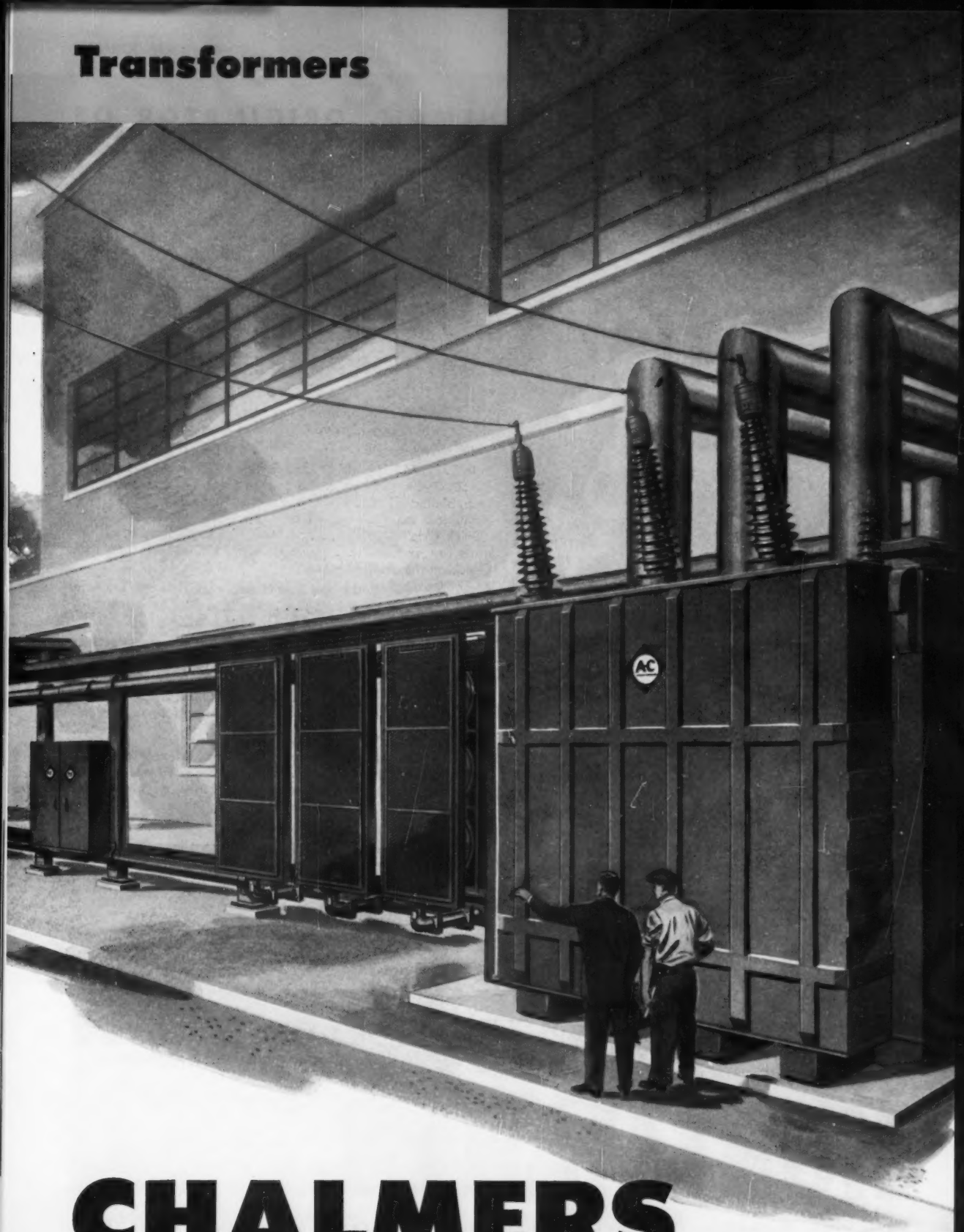
This is only one of many examples of Allis-Chalmers leadership in transformers. For further information about this interesting new development, call your nearest A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5132

# ALLIS-

**Transformers**



# CHALMERS

*To Serve Better - Electrically*

**KUHLMAN, ORIGINATOR OF "Quick Grip," INTRODUCES A**

# New High Voltage Bushing

## FOR RATINGS ABOVE 5000 VOLTS

Now, KUHLMAN affords new safety, new convenience and new speed in handling high voltage connections on cover bushings of pole type transformers.

In 1939, KUHLMAN introduced the first "Quick Grip" Bushing for 5000 volts and below. The principle of this bushing has, since then, been adopted by most of the country's leading transformer manufacturers. Linemen all over the world prefer KUHLMAN "Quick Grip" Bushings . . . no tools are necessary . . . no live parts are exposed . . . connections are simple, safe and fast. Check all these advantages:

***Easy Installation*** –the line lead is simply inserted into the hole in either side of the bushing . . . a twist of the knob completes the job!

***Complete Protection***—the protective knob reduces effects of weather, corrosion and the possibility of animals and birds disrupting service.

***Versatile Application***—new cover type "Quick Grip" will soon be available on all pole type distribution transformers. Accommodates full range of EEI-NEMA wire sizes.

Your KUHLMAN representative will be happy to explain this high voltage "Quick Grip" Bushing . . . it is another KUHLMAN feature that has provided new standards of distribution transformer service and long life for America's leading utilities.

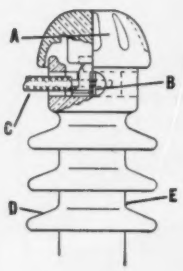
**A—Hard rubber cap protects — simple clockwise rotation clamps lead firmly.**

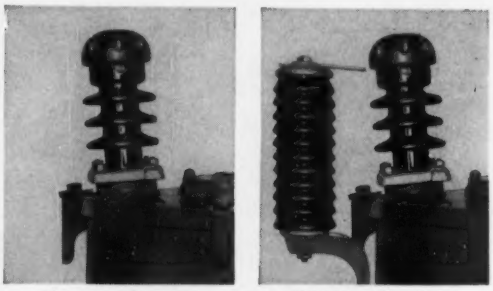
**B—Gap Electrode**

**C—Line leads . . . can be entered from two sides.**

**D—Porcelain.**

**E—Corrugations provide ample creepage distance.**



**Conventional or CSP Application**

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# Westinghouse Spurs Research

- Pres Gwilym A. Price hails company's new laboratories as 'most modern research facility' of the electrical manufacturing industry
- At new facilities, 40% of study is 'blue sky' type, 50% relates to the company's business, and only 10% is focused on a single product

**Gwilym Price: 'an epochal step'**

Westinghouse Electric Corp took "an epochal step" recently when it dedicated its new research laboratories near Pittsburgh. Gwilym A. Price, chairman and president of the corporation, hails the new laboratories as the "most modern research facility" of the electrical manufacturing industry.

There is a reason for Price's enthusiasm. Only 10% of the company's effort in the new laboratories is devoted to applied research—or as he defines it, "to work of a practical nature focused on a single product."

Fifty per cent, Price says, "is on what we call basic research—on the search for new knowledge in fields which relate directly to our business."

And 40% is on fundamental research—"work in fields of science basic to the electrical industry, but on specific projects which have little or nothing to do with our business as such." The Westinghouse executive claims that "no other industrial research center in the nation devotes so large an effort or so high a percentage of its work to pure science as does this one."

This last figure—40% for fundamental research—represents a $2.5-million outlay this year. Price observes that

**1** Electroluminescence . . .

# . . . New Lab Is Studying These

"some experts have named 8 to 10% as a desirable goal for companies to strive for."

The aim of the directors of the new research center, Price declares, is to "eliminate the 10% they spend on applied science and devote all the work of the center to fundamental and basic research."

The new facility is an important part of the company's over-all research and development program. Westinghouse is "spending $150 million this year on our total technical effort—on our research and development work," Price says. This is about 10% of the company's gross income.

The new research center gives the company's scientists 313,000 sq ft of working space—more than double the size of the old facilities. The building is situated on a 72-acre site in country-like Churchill Borough, just ten miles east of downtown Pittsburgh and the Westinghouse general headquarters.

More than 700 men and women work at the labs. About 450 of them are professional scientists, technicians, and assistants. Of these professional personnel, 38% are physicists, 24% chemists, 13% electrical engineers, 11% mechanical engineers, 7% metallurgists, and 4% mathematicians.

An increasing number of the professional scientists who join the Westinghouse research laobratories have acquired doctor's degrees. Of the scientists hired from universities this year, 72% hold doctorates.

The departmental arrangement of the Westinghouse research center provides for 11 departments. They are: physics, chemistry, mechanics, metallurgy, mathematics, electromechanics, insulation, electronics and nuclear physics, magnetics and solid-state physics, semiconductor and solid-state physics, and technology. These departments correspond closely to the various disciplines that are basic to the electrical industry.

The new building is a three-story L-shaped structure of red face brick trimmed with stainless steel panels on the office wings. Within it are some 50,000 pieces of intricate equipment worth more than $1 million.

The photographs on these pages illustrate just a few of the research projects that are now underway at the laboratories. These five projects are:

## 1 Electroluminescence

The photograph above shows a room illuminated by 112 glass panels, each one-ft square and as thin as a window pane. They give off a soft green shadow-less light.

Each panel consists of a sandwich of special phosphor powder between a metal film and a plate of electrically conductive glass. It emits light most efficiently at 350-v, 3,000-cps ac. (EW, Sept. 17, p. 267).

Westinghouse scientists estimate the maximum future efficiency of electroluminescent panels will be about 240 lumens per watt—almost four times that of today's fluorescent lamp. However, the present efficiency of the panel is only 9 lumens per watt.

## 2 Solventless Silicone

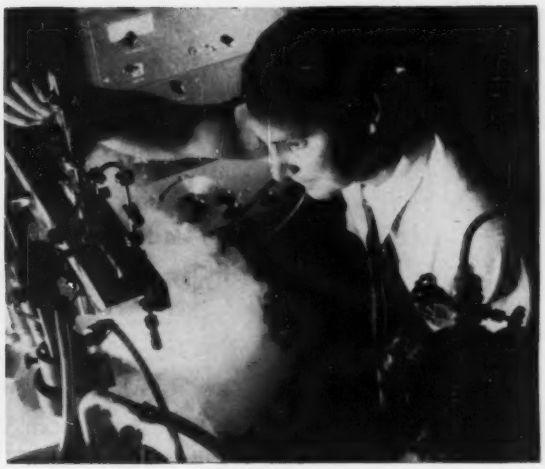
A scientist demonstrates the heat-resistant properties of a new solventless silicone resin (at left in photograph No. 2). It remains intact on a hot plate while a conventional insulating resin (right) smoulders from the heat. This new high-temperature and high-voltage insulating material was developed jointly by Westinghouse Electric and Dow Corning Corp.

Solventless silicone produces an insulation entirely free of air-space or "bubbles." Westinghouse says it provides greater heat resistance and is another step toward the operation of electrical equipment at higher output or in higher ambient temperatures.

## 3 Superconductivity

An example of fundamental research is the investigation

**2** Solventless Silicone . . .



**3** Superconductivity . . .

# Five Projects

of the "why" of superconductivity—the strange behavior of certain metals in which, at extremely low temperatures, electric currents apparently flow forever.

Scientists test this theory by directing microwaves at a superconducting metal such as aluminum or tin that is held at a temperature less than one degree above absolute zero. They then measure the energy needed to raise the metal's temperature to its normal conducting state. This is in the order of about one-millionth of a watt.

To keep the metal at about −459F, it is immersed in liquid helium inside a special flask which is itself surrounded by a similar flask of liquid nitrogen at −320F.

### 4 High-Temperature Metals

Inside this tank-like electric furnace (photograph No. 4), steam at 1,200F and under a pressure of 16,000 psi is being used to test the strength of a stainless steel casing. The casing will house the super-pressure element of a new turbine that will operate at 1,200F and a steam pressure of 5,000 psi.

The tests are designed to measure the distortion and ultimate breaking strength of the turbine casing when it is subjected to these extreme temperature and pressure conditions for a long time.

### 5 Arc Quenching with $SF_6$

The photograph shows a Westinghouse research scientist injecting sulfa hexafluoride gas ($SF_6$) into a tube through which a 10-kv arc is being generated. The gas promptly quenches the arc (EW, Sept. 10, p 26).

By studying the interaction of electrons, molecules, and atoms in gases, Westinghouse scientists hope to understand better the basic principles involved. They have found that $SF_6$ has great promise in quenching electric arcs. It is one of the electronegative gases that have the "unique ability to capture electrons."

**4** High-Temperature Metals . . .

**5** Arc Quenching with $SF_6$

# Where Europe Stands in Cable Art

**Following tour of manufacturers and proving grounds in four countries, a U. S. cable expert reports on status of cable development in Europe:**

- **Power Cable—Impregnated paper-insulated is most widely used**
- **Low-Voltage Cable—Large increase in use of thermoplastics**
- **Extruding—Great interest in the continuous lead press**
- **Manufacturing—U. S. cables equal European in insulation firmness**
- **Research—Most companies have extensive facilities**
- **Testing—Cable for English Channel crossing gets severe tests**

**R. J. WISEMAN,** Vice President and Chief Engineer, Okonite Co, Passaic, N. J.

A recent tour of major cable manufacturers and proving grounds in England, France, Germany, and Italy disclosed the following European cable developments:

• **Power Cables**—Impregnated paper-insulated cable is the most widely used for all voltages.

• **Low-Voltage Cables**—There has been an enormous increase in the use of thermoplastics, particularly polyvinyl chloride.

• **Extrusion Methods**—Great interest is being taken in continuous lead presses. Every one of the manufacturers in the four countries visited has at least one.

• **Manufacturing Methods**—The author did not see any European cables that are superior to American cables in degree of firmness of insulation and uniformity of taping.

• **Research**—Most companies have extensive research facilities not only for the impregnated paper-insulated cables but also for rubber and thermoplastics.

• **Testing**—Engineers at Fontenay proving grounds in France have carried out some interesting research on the power cable for the English Channel crossing. They designed a test setup to duplicate the conditions under which a submarine cable is drawn from the hold of a wave-tossed barge and payed off into the water.

The demand for electric power is increasing as rapidly in Europe as in the U. S.—in the order of 7 to 8% annually, except in Germany where it is 10 to 12%. The actual power capacity in each country is in the order of 15 to 18-million kw. As to be expected, transmission of power is predominantly by overhead lines, but there are some underground cable lines around cities at voltages up to 230 kv. In Sweden 425-kv lines link the Harspranget Station inside the Arctic Circle to Stockholm, with very short insulated cables for station ties between the transformers and the switchyards for the outgoing lines.

## Power Cables

Impregnated paper-insulated cable is the most widely used power cable in Europe for all voltages, although polyvinyl-chloride-insulated cables are being used to an increasing extent for low voltages. There does not seem to be much of a change in manufacturing practices in the past four years. The same types of oil are being used for both solid, oil-filled cables of the Pirelli type, and high-voltage cables of the high-pressure-gas type.

British Insulated Callender's Cables has a cable known as MIND—mass-impregnated non-draining. It contains a very high percentage of wax, which makes the compound similar to our petrolatum cables of 30 years ago. The MIND cable is now being used up to 11 kv, but they believe it is suitable for 15 kv. Les Cables de Lyon has a cable with heavy compound being tested at the Fontenay proving grounds of Electricite de France. The tests are conducted at 63 kv on vertical risers. So far, it is operating satisfactorily.

Two types of compound are being used for high-pressure-gas cables. One has a high content of polyisobutylene in a mineral oil, and the other a high resin content. The former gives a flatter power factor-temperature curve than the one with the resin.

## Low-Voltage Cables

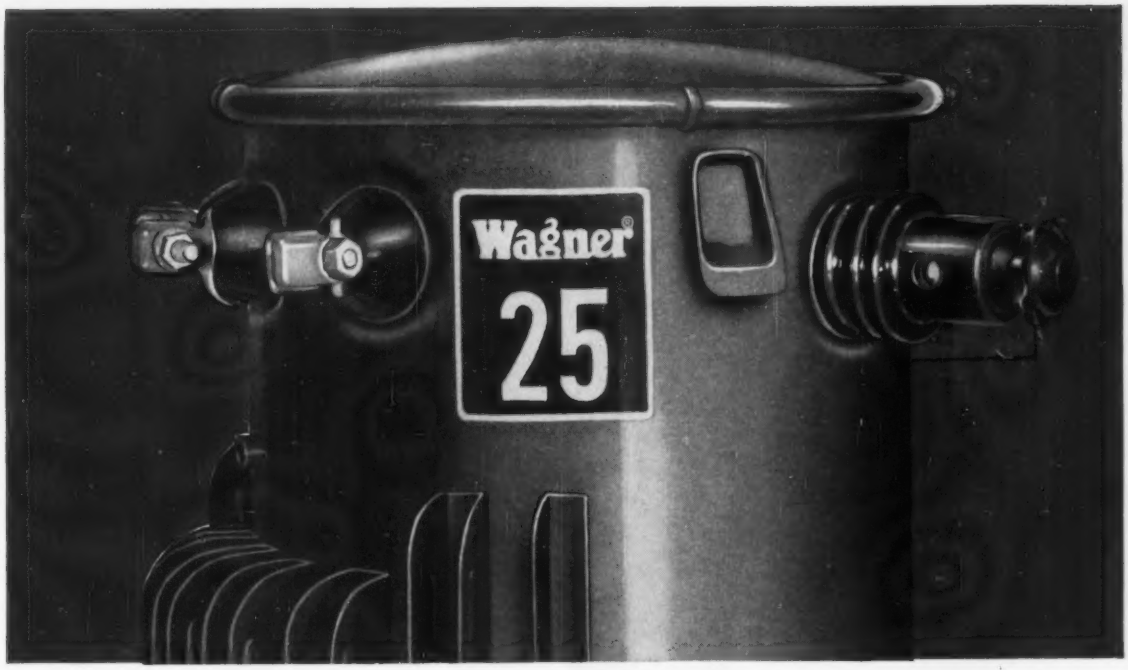
Although England, France, Germany, and Italy are concentrating major interest in impregnated paper cables for all voltages, there are still plenty of low-voltage rubber cables being manufactured. The limiting voltage seems to be about 1.5 kv, but there are a few cases as high as 15 kv.

European manufacturers were surprised to learn that rubber-insulatd cables are operating in the U. S. as high as 35 kv. However, one English cable manufacturer is carrying out some very intensive research on the chemistry of rubber and the influence of various fillers in the compound. He is also investigating the degree of water absorption and its effect on power factor and capacity when voltage or no voltage is applied.

It is interesting to note that a cable with no continuously applied voltage will show a higher power factor than one on which voltage is applied continuously. So far, no explanation has been found for this phenomenon.

Some Butyl rubber is being used, and many companies are conducting research to become acquainted fully with its physical and electrical properties. As in the U. S., they find that Butyl rubber compounds show good heat-aging properties physically and for power factor. However, they are also concerned with the erratic voltage

(*Continued on page* 30)




# Wagner Form W Transformers

## offer smaller size—lighter weight—sealed tank construction—key-locked safety bushings

Wagner Form W Distribution Transformers, with wound cores and improved insulation, are now considerably smaller in size—lighter in weight than ever before. Yet they are liberally designed for excellent electrical performance—low core and copper losses—good regulation—high overload capacity for peak loads. Sixty-five years of transformer manufacturing experience are your assurance of Wagner dependability. Specify Wagner for your lines—get these proven features:

Only Wagner offers the Shur-seal cover design that keeps the transformer as air-tight as a welded tank, yet lets you remove the cover by loosening a single bolt.

Low voltage bushing and terminal are key-locked to prevent turning when tightening. Reduces danger of internal shorts. Takes copper or aluminum conductor.

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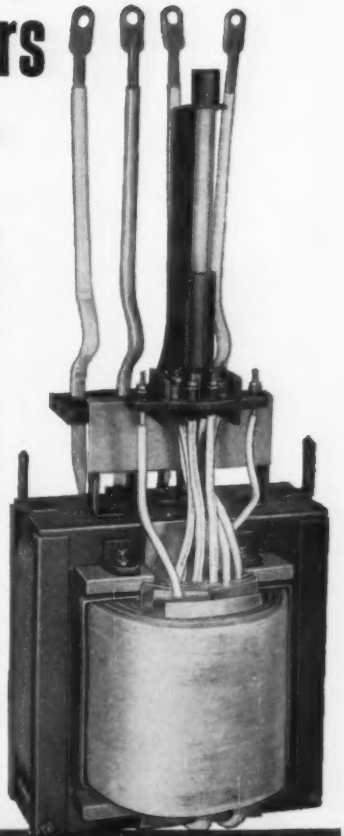
New Form W Element with cold-rolled wound core. Thermosetting insulation bonds coil element into a solid unit, braced to prevent shifting inside tank.



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**G.E.'s uprating service can also save you money.** In addition to simply replacing burned-out cores and coils, your G-E Service Shop can uprate old and burned-out transformers both in kva and voltage, and can also convert conventional-type units to self-protected units if you wish. A conventional 1½- or 3-kva, 2400-volt transformer, for example, can usually be uprated to 5 kva, and a 5-kva unit to 7½ or 10 kva, either 7200 or 7620 volts, and converted to a self-protected type. Both routine rebuilding and emergency repairs are as near as your telephone—there are 34 G-E service shops in major cities.

**Look at the other money-saving features** that prove "all transformers are not alike": **Impulse testing,** for instance, saves years of transformer life. **One-piece clamping bands** save maintenance time. Re-usable **Nitrile rubber gaskets** help save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor terminal clamps** save terminals from breaking. **Super Melaglyp paint** saves up to two repaintings. **Nationwide warehouses** save utilities heavy inventory expense.

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| FEATURE | General Electric | Mfr. A | Mfr. B | Mfr. C | Mfr. D | Mfr. E |
|---|---|---|---|---|---|---|
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| Nitrile rubber gaskets | √ | | | | | √ |
| One-piece clamping band | √ | | | | | |
| H-v and l-v terminals handle both copper and aluminum conductors | √ | | | | | |
| Strenicor pressure terminal clamps | √ | | | | | |
| Super Melaglyp paint | √ | | | | | |
| More than 100 warehouses | √ | √ | | | | |
| Nationwide, company-operated service shops | √ | √ | | | | |

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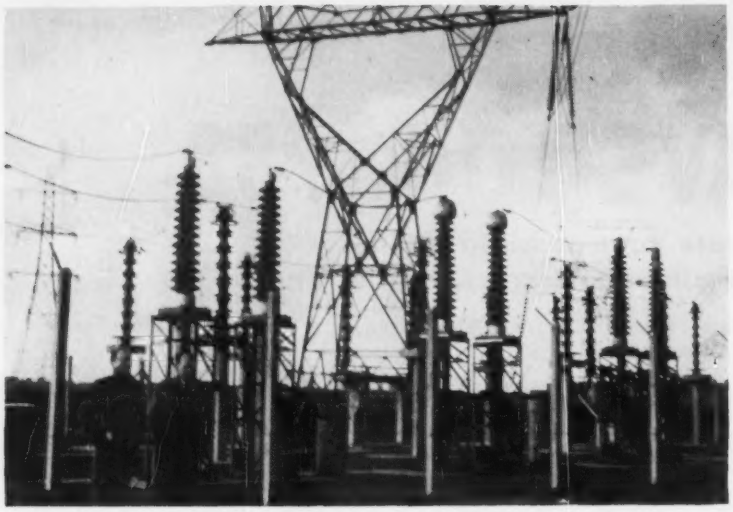


**AT STAYTHORPE PROVING GROUNDS in England, the testing station is tapped in on one phase of 275-kv double-conductor overhead lines leaving the plant**

breakdown that results from air entrapped in processing. European cable manufacturers are giving active attention to this matter. They believe that a Butyl rubber insulation will replace natural rubber to a high degree, provided the price of the raw material improves.

There has been an enormous increase in the use of thermoplastics, particularly polyvinyl chloride, in the past four years. In fact, it is replacing both rubber and impregnated paper in the low-voltage field. Some companies are studying the degree of purity of the basic material and the plasticizers. Consequently, they have some installations of 11 kv and believe that they can go to 15 kv. Of course, these cables are shielded over the insulation and, in most cases, at the conductor also.

Some manufacturers are supplying a small amount of polyethylene-insulated cables for power purposes, but mostly for telephone, radio, and television transmission. And some are supplying foam polyethylene, or "expanded polyethylene" as they call it.

## Extrusion Methods

Nearly every European manufacturer makes his own PVC composition from powders, and also extruders and the dies for them. There are American, French, and German rubber and thermoplastic extruders as well as those made by the cable manufacturer himself. There are extruders with large and small heads, and steam and electric heat. Use is determined by job.

The manufacturers control closely the speed of the extrusion by means of gauges that indicate continuously the degree of departure from the required diameter. This stems from the necessity to save material. The author saw one installation in which PVC was beting extruded on a wire, and the diameter was varying less than one mil.

Aluminum sheathed cables are being supplied but not to the extent of several years ago. This decline is due to the reduction in the price of lead, but the physical properties of aluminum are still a factor for the interest in this metal.

For protection against corrosion, PVC is used alone or in combination with rubber compounds. For example, they will put a covering of PVC, then a self-curing rubber compound, and finally PVC again. The rubber layer acts as the moisture seal.

The swedging or drawing-down process of aluminum sheathing is most widely used although some German manufacturers are using direct sheathing. This author saw direct sheathing on a single-ram press for telephone cables, but neither on a single-ram or double-ram press for power cables.

One English manufacturer is extruding tubing on a double-ram press, and it is later drawn down on a cable. One German company uses a very large vertical double-ram aluminum press to extrude tubing and also directly over a cable. To keep the press busy, they will extrude rods and shapes. At the time of the visit, they were extruding simultaneously three one-in. rods which were then wound on large diameter reels.

Great interest is being taken in continuous lead presses, and every one of the manufacturers in the four countries visited has at least one. There are three types of continuous lead presses: (1) The Pirelli-General made by Pirelli-General Electric Co of Eastleigh, England; (2) The Pirelli-Milan made by Pirelli Co of Milan, Italy; and (3) The Swedish Hanson press made by Hydraulik of Duisburg, Germany, and J. W. Robertson Co in Brooklyn, N. Y.

The Pirelli-General press is a double-screw water-cooled press. The Pirelli-Milan press is single-screw air-cooled, and the Hanson press is single-screw water-cooled. All three successfully extrude regular commercial lead—that is, unalloyed lead. However, the situation is different for alloyed lead, particularly antimonial lead having an antimony content of 0.75% and higher. No one, except the Pirelli-General Electric Co, stated that the Pirelli-General press could extrude an antimonial lead alloy. However, because of the alloy's hardness, the press could be run only at 25% of its normal rate. This press does run Alloy "E" which has 0.4% tin and 0.2% antimony and ½ Alloy "C" which has 0.2% tin and 0.075% cadmium.

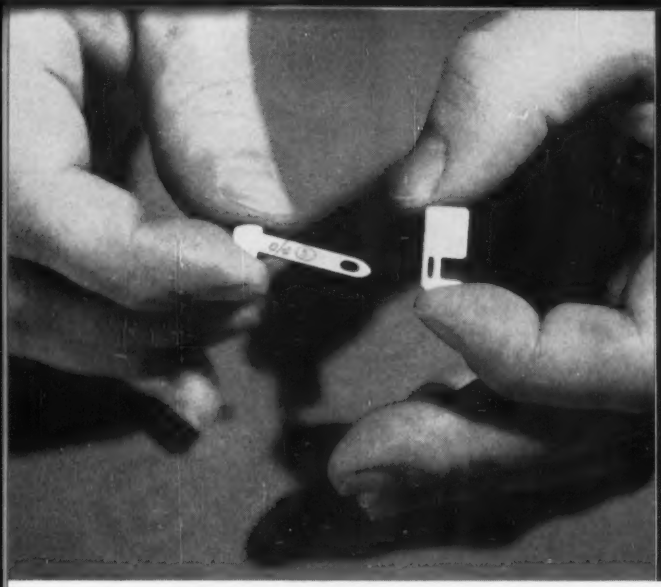
This author saw the Pirelli-Milan extrude 0.75% antimony. The makers of the press claim that this can be done by a single-screw air-cooled press, and they expect to be in production soon. The Hanson press is now under experimentation using granular antimonial lead.

Both the Pirelli-Milan and Hanson presses are worthy of consideration for extrusion of antimonial lead sheaths.

## Manufacturing Methods

Manufacturing methods in Europe have not changed much. A few companies have what may be considered the last word in paper-taping machines and controlled humidity in the taping room. However, other companies—and ones that stand equally high in the high-voltage cable field—have ordinary paper tapers, no elaborate tension control devices, and no humidity control. Yet they still ap-

(*Continued on page* 32)



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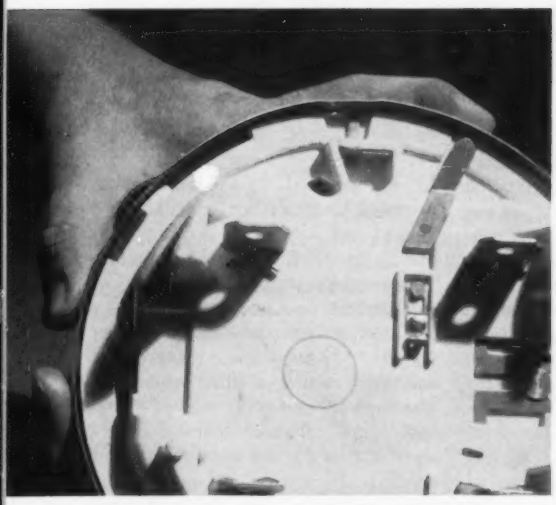

**NO MORE COSTLY THREADING OF LEAD SEALS.** You can seal meters faster, cheaper with the Sangamo OK Seal. Your shop tested meters stay sealed—as calibrated.

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If Sangamo meters are opened, they can be easily and inexpensively resealed with the Sangamo time saving seal or with a conventional lead button seal. Sangamo OK Seals are competitively priced—available for your use. Write for further information and prices today.

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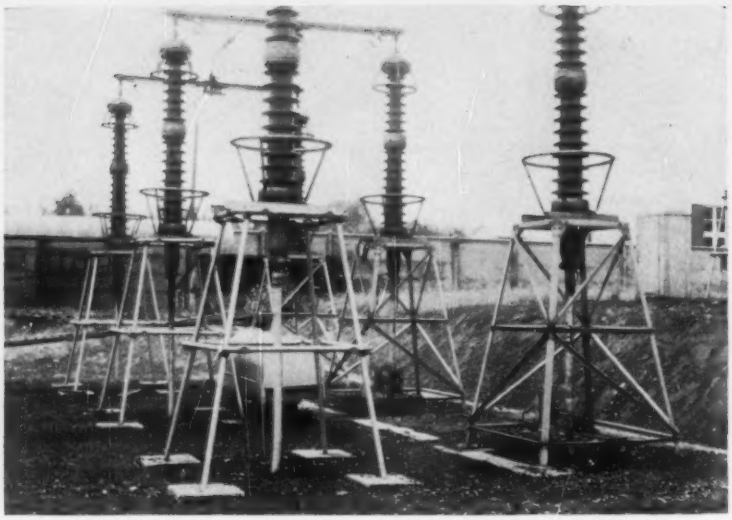

**AT FONTENAY PROVING GROUNDS in France, research was carried out on types of cables comparable to designs offered for the English Channel crossing**

pear to be putting out good quality cable.

It makes this author wonder if we are emphasizing too much how important it is to get perfect taping and freedom from wrinkles, registrations, and soft spots. Only one company visited on this trip (Les Cables de Lyon) uses paper tape thicknesses less than 1 mil. One company not visited, Liljeholmens of Sweden, uses less than 1 mil thicknesses also.

All other manufacturers do not believe it is necessary to use less than 2-mil thicknesses. All companies grade the heavy walls, usually in combinations of 2, 3, 3.5, 5, and 6.5 mils. All use electric heating of the conductor for heavy wall insulation and a vacuum better than 1 mm during the drying period. All but a very few companies use 2 to 3 atmospheres (30 to 45 psi) during impregnation.

This author has not seen any European cables that are superior to American cables in the degree of firmness of insulation and uniformity of taping. There are more European companies using conductor heating than U. S. manufacturers. All but a very few European companies are interested in furnishing 69-kv cable and over, but there does not seem to be much demand. Some companies have very fine equipment for making low-pressure oil-filled cable, and they use a lower viscosity oil than in the U. S. This author doubts if they are turning out a product superior to ours.

British Insulated Callender's Submarine Cable Co recently manufactured four 16-mile single-piece lengths of 138-kv pre-impregnated high-pressure gas cable for British Columbia Electric Co, Vancouver. (EW, Sept. 17, p 146). On viewing Callender's manufacturing equipment and procedures, this author was impressed with the care exercised in every operation. The planning and execution were designed to prevent, as far as possible, anything that could result in damaged or sub-quality cable.

Here is an example of Callender's resourcefulness. The paper-taping and leading operations were carried out simultaneously. They were able to continue the leading operation while replacing the paper rolls, and to continue the paper taping while recharging the lead press.

## Research

The majority of the cable manufacturers have extensive research facilities not only for impregnated paper-insulated cables but also for rubber and thermoplastic. Studies are being conducted in the chemistry of rubber and plastics and in the influence of moisture, oxidation, and heat aging on electrical properties.

Germany seems to be doing the most on thermoplastics, particularly on the polyvinyl chloride type. Pirelli-Milan appears to be leading the studies on epoxy resins, and its efforts are concentrated on joints and stress cones for termination of high-voltage cables. This resin seems to have great promise, especially for stop joints.

All manufacturers have impulse generators for making impulse tests on high-voltage cables. They range from 1,000 to 2,500 kv, and some are planning to install 3,000-kv sets.

There is an increasing interest in high-voltage dc transmission in Europe, particularly for submarine cables. To carry out researches, Siemens-Schuckertwerke in Berlin has a 2,000-kv dc set that can be operated continuously to deliver 100 milliamp.

## Testing

There are three testing stations in Europe where power cables may be tested for long periods at higher than rated voltages and temperatures. The oldest of these is at Arnhem, Holland. It is known as KEMA—N. V. tot Keuring Van Electrotechnische Materialen, or Testing Laboratory for Electrical Material, Ltd. It is under the direction of Prof J. C. Van Staveren.

When this author first visited KEMA in 1936, they were testing 132-kv cables. It was destroyed during World War II but has been rebuilt and is now equipped fully for testing cables up to 330-kv.

The second test station is Electricite de France's proving ground at Fontenay, just outside Paris. It is a very fine laboratory for testing high-voltage transformers, circuit breakers, cables, and relay equipment. Manufacturers supply the cables, and the power company does the testing.

The test voltages at Fontenay are the power supply voltages to the station: 63, 132 and 224 kv. The engineers like to test cables at $\sqrt{3}$ times the working voltage. This means that they would test 35-kv cables on one phase of the 63-kv line; 69-kv cables on one phase of the 132-kv line; and 132-kv cables on one phase of the 225-kv line. A 225-kv cable would be tested by insulating the cable from ground and putting the conductor on one phase and the sheath on another. Transformers are available to supply any desired current.

Cable designs tested at Fontenay include 139-kv cable, low-pressure and high-pressure oil-filled cables, and high-pressure gas-filled cables. They have tested cables comparable to designs offered for the English Channel crossing. In general, oil-filled cables stood up better than the high-pressure gas cables.

(*Continued on page* 36)

L-M's modern 1957 fluorescent luminaire is styled for handsome appearance, correct light distribution, and a lifetime of efficient, economical operation. It is the only fluorescent luminaire designed to take both present and future very high output fluorescent lamps.

# Line Material Announces New, Advanced 1957-Style Fluorescent Luminaires

L-M's new fluorescent luminaires offer an exciting new look in street lighting equipment. The units provide more comfortable visibility, and greatly increase the scope of vision for both motorists and pedestrians.

L-M's new luminaires are the only units available today that are designed to take both present and future VHO (very high output) fluorescent lamps.

The new luminaires have a long, slim modern look, and retain all the outstanding performance characteristics of L-M's original design. Their broad, cool, white light source provides virtually glareless illumination —the ultimate goal in lighting.

L-M's modern fluorescent luminaire distributes the light over a broad area, giving good balance between building and road surfaces.

These new street lighting luminaires are available in deep and shallow styles, in both four- and six-foot lengths. For other outdoor lighting applications, such as parking lots, store front lighting, etc., other styles are available.

### Get Complete Information

Get details of L-M's new 1957-style fluorescent luminaires. L-M Street Lighting Engineers will cooperate with you in designing the best lighting system for your area. Ask your L-M Field Engineer or Street Lighting Engineer for more complete information. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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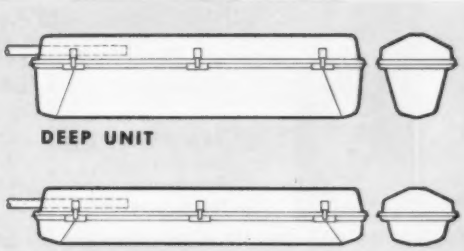


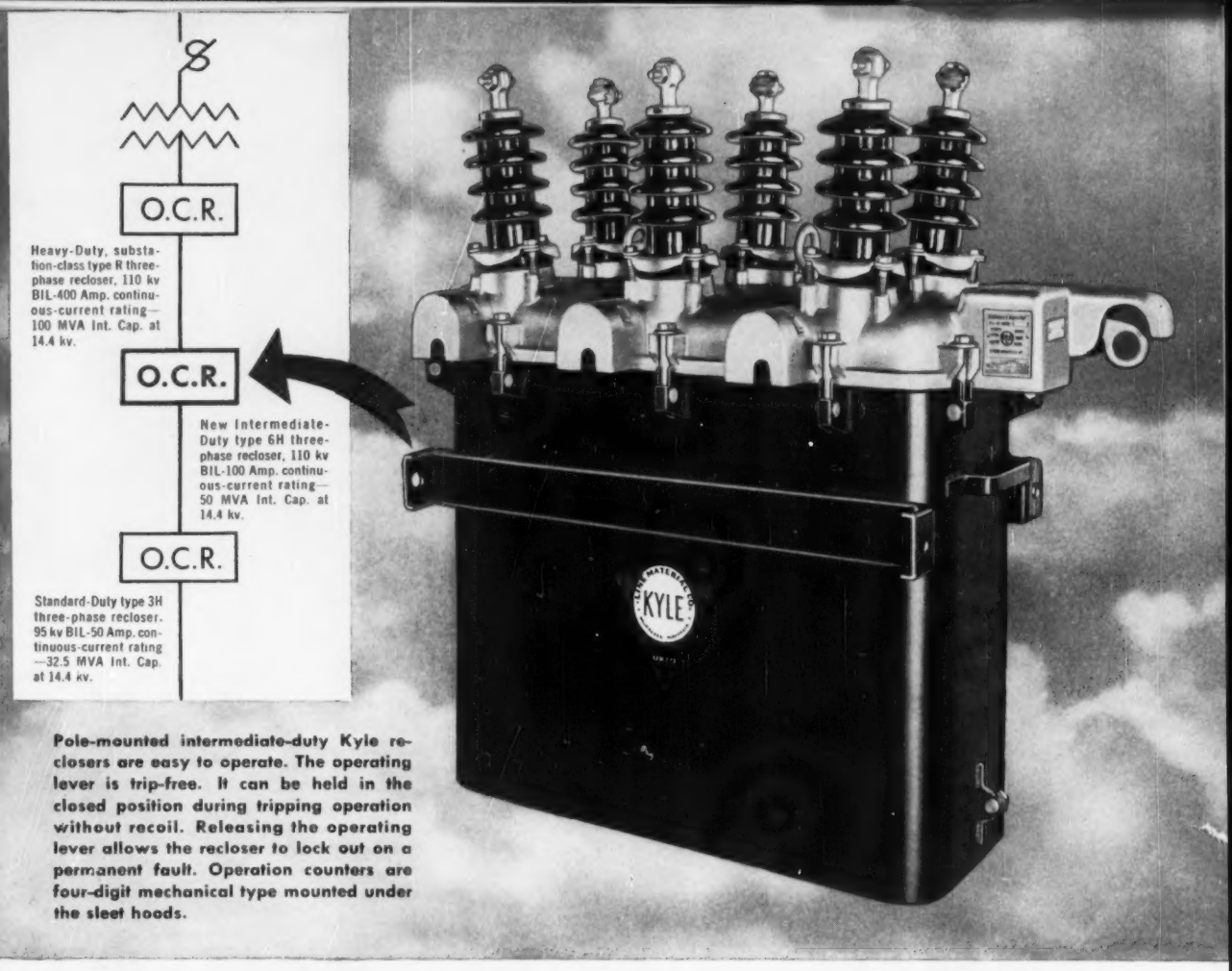
DEEP UNIT

SHALLOW UNIT

**Deep and shallow units are available in both four- and six-foot lengths. L-M's new fluorescent luminaires provide excellent light distribution for all applications.**

**LINE MATERIAL** Street Lighting

A McGRAW ELECTRIC COMPANY DIVISION


O.C.R.
Heavy-Duty, substation-class type R three-phase recloser, 110 kv BIL-400 Amp. continuous-current rating—100 MVA Int. Cap. at 14.4 kv.
O.C.R.
New Intermediate-Duty type 6H three-phase recloser, 110 kv BIL-100 Amp. continuous-current rating—50 MVA Int. Cap. at 14.4 kv.
O.C.R.
Standard-Duty type 3H three-phase recloser. 95 kv BIL-50 Amp. continuous-current rating—32.5 MVA Int. Cap. at 14.4 kv.
KYLE

**Pole-mounted intermediate-duty Kyle reclosers are easy to operate. The operating lever is trip-free. It can be held in the closed position during tripping operation without recoil. Releasing the operating lever allows the recloser to lock out on a permanent fault. Operation counters are four-digit mechanical type mounted under the sleet hoods.**

# L-M Announces New Intermediate-Duty Kyle® Reclosers For Overcurrent Protection

**New type 6H 3-phase reclosers incorporate all outstanding features of L-M's high-speed Kyle reclosers; available in 5 to 100 ampere ratings, 2.4 to 14.4 kv; symmetrical interrupting ratings to 3000 amps. Type 4H single-phase, intermediate-duty reclosers also available.**

By **WILLIAM J. WEINFURT**
Chief Engineer
Kyle Products
Line Material Company

L-M's new type 4H single-phase and type 6H three-phase reclosers are self-contained, intermediate-duty units, designed to segregate permanent faults, and to clear transient or non-persistent faults on urban and rural distribution systems. They provide high-speed circuit clearing in less than 2 cycles with symmetrical RMS interrupting ratings up to 3000 amps. 4.8 kv and below, and 2000 amps. 14.4 kv.

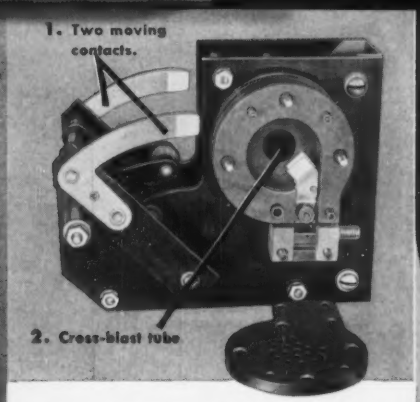
### Retain Kyle Design

All the outstanding features of L-M's Kyle reclosers are incorporated in these new intermediate-duty reclosers. The timing mechanism is the service-proved Kyle hydraulic system with a selection of three time-current characteristics: Fast (A), Retarded (B), and Extra Retarded (C). Sequences can be easily adjusted for 2, 3, or 4 operations to lockout in any combination of operations. The type 6H provides single-phase tripping with operation counter for each phase, but lockout of one phase causes simultaneous lockout of all phases.

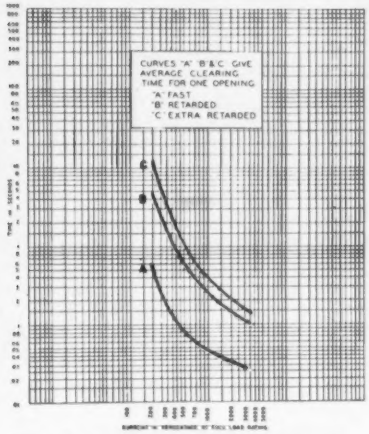
### Contact Structure

Contacts and arc interrupter structure utilize the snap toggle contact action and cross-blast arc extinction principle. The cross-blast consists of two arcs drawn in series as the contacts part. Pressure

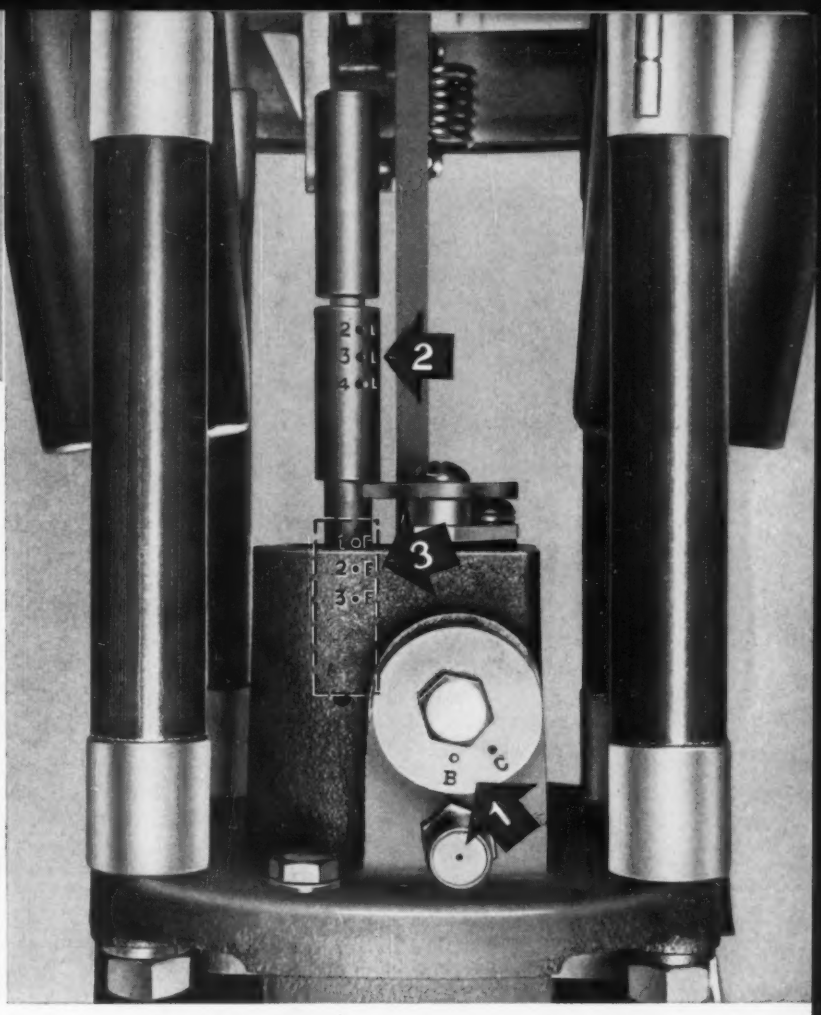
LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION




The new intermediate-duty reclosers utilize the service-proved cross-blast arc extinction principle. Two arcs in series are drawn as the contacts part **(1)**. Pressure generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Note the long double-break **(2)** and cross-blast tube connecting the two interrupting chambers.




**Time-Current Curves** for series overcurrent tripping of L-M's intermediate-duty Kyle reclosers. Each phase of the type 6H trips individually until the final pre-selected operation, when all three phases lock open simultaneously.




Time-current characteristics and operating sequences can be easily adjusted in the field. Photo shows the hydraulic system of the type 6H recloser. Time-current characteristic is selected by moving disc to curve "B" or "C" **(1)**. Number of operations to lockout is selected by adjusting vertical extension of lockout piston **(2)**. Adjustment of sequences (number of fast and delayed operations) is obtained by the proper positioning of the roll pin located at **(3)**.

generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Arcing time over the range of fault current ratings averages less than one-half cycle.

Moving contacts are silver-plated copper tungsten to reduce pitting and assure long life to the arcing surface. In operation, the moving contact wipes into the stationary contacts, thus insuring a cool, low-resistance, load-carrying contact. In addition, all current-carrying parts of the contacts are silver-plated.

### External Construction

Terminals are universal plated type and will accommodate either copper or aluminum from No. 6 solid through 250 MCM stranded in either a vertical or horizontal position.

Bushings are wet-process, 15 kv porcelain, externally clamped to head. Bushings have approximately 12″ creepage distance. The recloser will also be available with 15″ creepage-distance bushings where desired.

### Get The Whole Story On L-M's Kyle Reclosers and Sectionalizers

L-M offers the most complete line of reclosers—single- and three-phase—from substation to load. Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

**Kyle type 6H 3-phase reclosers available in normal load ratings FROM 5 TO 100 AMPERES***

| Ratings Amps. | Min. Trip Amps. | Inter. Ratings RMS Amperes 2.4-4.8 kv | Inter. Ratings RMS Amperes 14.4 kv |
|---|---|---|---|
| 5 | 10 | 200 | 200 |
| 10 | 20 | 400 | 400 |
| 15 | 30 | 600 | 600 |
| 25 | 50 | 1000 | 1000 |
| 35 | 70 | 1400 | 1400 |
| 50 | 100 | 2000 | 2000 |
| 70 | 140 | 3000# | 2000 |
| 100 | 200 | 3000# | 2000 |

*Insulation Level: 110 kv BIL.
#2,500 RMS amperes maximum Inter. rating at 8.32 kv.

# Kyle® Reclosers

The third European testing station is set up about one-half mile from Central Electricity Authority's 360-Mw Staythorpe power plant near Newark, England. The testing station is tapped in on one phase of the 275-kv double conductor overhead lines that leave the station for Manchester and south England. This arrangement brings the voltage to four 230-kv test cables laid out in loops in the ground and in series so that the power load of the station passes through them, and the cables are subject to voltage surges that may occur.

### Four Cables under Test

The four cables are: (1) a British Insulated Callender's low-pressure oil-filled cable, (2) a Pirelli-General low-pressure oil-filled cable, (3) a British Insulated Callender's impregnated paper cable—a self-contained high-pressure gas cable, and (4) an Enfield compression cable.

Up to the present, there has been very little load on the four cables. They have measured soil thermal resistivities of 30-40 thermal ohm-cm with the result that the temperature rise is very low, not more than 15C. They are getting some 375-Mva transformers which will give them 780-amp load, and they hope for more realistic temperatures on the cables. However, it is questionable that they will reach 5C over the desirable operating temperature because of low soil thermal resistivity.

### Channel Cable Tested

Fontenay engineers have carried out some interesting research on the power cable for the English Channel crossing. The trial runs made a few years ago on laying, splicing, and picking up of cables brought out two subjects for further investigation. One was the need for a flexible joint—one that could be made on a cable that would be wound in the hold of a boat and easily payed off. Another point was the fatigue of the lead sheath due to intercrystalline fracture resulting from the motion of the barge —this caused flexing of the lead sheath between the edge of the barge and the cable in the water.

Fontenay engineers designed a test set-up to duplicate these conditions. They found that the lead would fracture in about 18,000 cycles. Based on a time period of 6 sec per cycle for the barge, this is equivalent to 30 hr. As it would take a longer time to make a joint, it was necessary to find a way to meet the situation.

They discovered that by keeping a tension of 0.5 metric ton (1,100 lb) on the cable, they could increase the number of cycles ten times before fracture occurred. Tests were carried out also on the fatigue resistance of the lead sheaths on compression cable due to the pressure of the hydrostatic head of water and the sudden loss of internal pressure. So far, these tests have not been too successful.

For the English Channel crossing they are favoring a cable design which can be made in very long lengths. Most designs seem to be limited to 2,000 ft, and engineers feel that this is too short and will require too many joints. For ac power, English engineers are looking favorably upon the same design of cable as was supplied to British Columbia Electric Co by British Insulated Callender's Submarine Cable Co.

### French Favor DC for Channel

But the French decided in favor of dc power at 200 kv to ground to carry 100 Mva, and this is now being considered (See article on page 16 in this issue). A dc type of cable design would be entirely different—a smaller conductor and light wall of insulation could be used with solid-type cable construction.

Power utilities in England are becoming cable-loading conscious as a result of increased power consumption and the large capital investment in cables. They are beginning to experience the heavy loads that we have had for the past 20 years. Because at least 90% of their cables are direct buried, the thermal resistance of the soil is a big factor in allowable loading. It has been customary to use a soil thermal resistivity of 120 thermal ohm-cm when computing a cable's current-carrying capacity. However, the latest current-loading tables have current values based on 90 and 120 thermal ohm-cm. The cable manufacturers are not too pleased about this.

### Manufacturers Aid Tests

In order to get factual data on which to base future loadings, a co-operative investigation is being carried out by the Electrical Research Association (ERA) representing the manufacturers and the various electrical authorities (EA). The EA group is furnishing cables and installation locations, and the ERA is paying for half the cost of the investigation. The tests will cost about 20,000 pounds and will run about 10 years.

There will be about 40 cables under test at various installations throughout Great Britain. In some locations there will be one small-diameter and two large-diameter cables; in others there will be two small and one large. Mutual heating between adjacent cables will be studied in one case.

The cables will be subjected to increasing power loads, and thermocouples will be placed on the sheaths and around the cables in the soil. This test is expected to determine at what sheath temperature the soil will dry out and cause runaway temperatures. It will also be a means of restudying soil thermal resistivities. This will be important as there are some locations where there is a sand and chalk soil—a poor conductor of heat.

### Europeans Eye U.S. Tests

Various European cable groups offered some interesting reactions on learning about the 345-kv cable test program being planned by the Cable Engineering Section, Power Distribution Committee, Association of Edison Illuminating Companies. Four U. S. cable manufacturers and two pothead manufacturers are cooperating in this program which is under the chairmanship of L. I. Komives.

### Suggest U.S. Test Changes

This program was described to the European cable manufacturers visited by the author, to CIGRE Committee No. 2 on Cables, and to Central Electricity Authority and Electricite de France. Their reactions ranged from complete agreement to suggestions for modifications. Some of the changes suggested are: (1) limiting the temperature at which the cable will be tested to only 5C above the operating temperature, and (2) emphasis on the impulse testing of cables after completion of the load and overvoltage tests in preference to an ac voltage test to breakdown.

Their views seem to be influenced by their practice for the type of cable they now furnish for 230 kv. The ones who manufacture oil-filled cables did not object to the specification as such but suggested additional tests. This author's reaction is that the program is practical and should give the information we are seeking.

*ANOTHER REASON WHY UTILITIES EXPECT MORE FROM*

**POWERS** *American*

***Setting the pace...***

# Pole-Master®

## HYDRAULIC DERRICKS

***3 MODELS... 7 SIZES***

You just can't beat the cost-cutting convenience of Pole-Master. At the flick of a lever, powerful hydraulic cylinders move the derrick to the position that's *exactly* right for the hoisting job. There's no exposed mechanism. Head sheave can be threaded from the ground.

When it comes to capacity, Pole-Master equals or surpasses conventional derricks of comparable rating. It stows *above* the body... never obstructs valuable cargo area space.

Aren't these the features you've long wanted in a derrick for your job?

**The powerful Series PM-2 Pole-Master, shown above on a Powers-American Series 800-C Line Body, is available in sizes for handling 40′, 55′, and 70′ poles.**

**DESCRIPTIVE LITERATURE ...plus complete price information IS YOURS FOR THE ASKING!**

## McCABE-POWERS AUTO BODY COMPANY

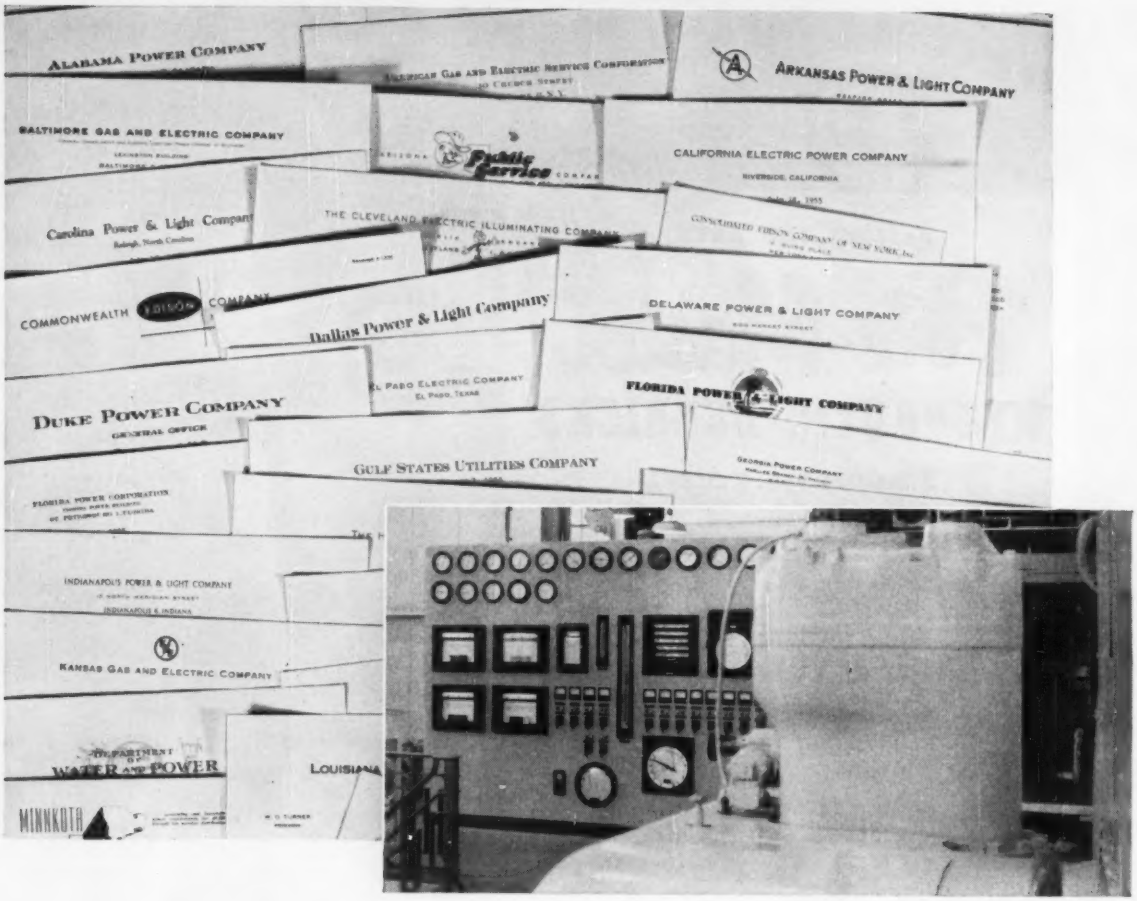
5900 NO. BROADWAY • ST. LOUIS 15, MO.

625 CEDAR ST. • BERKELEY 10, CALIF.

Series HD-2 Pole-Master Derricks can be furnished in sizes for handling 40′ and 55′ poles.

The Series HD-4 Pole-Master, actuated by four hydraulic cylinders, handles 55′ and 70′ poles.

Powers-American conventional derricks, tripod or T-type, are available in all sizes and capacities.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EL PASO ELECTRIC COMPANY
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# You're in good company

## *when you choose . . . Honeywell instrumentation*

You join America's best-known electric power generating companies in your choice of instrumentation by Honeywell. You'll find Honeywell instrumentation everywhere . . . in large stations and small. The reasons for this are clear.

With the precision, stamina, and reliability of Honeywell instruments, you get an important extra . . . service. This service begins with your first plans, and continues long after your instruments are installed. It includes:

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**Quick shipment of spare parts,** from your local Honeywell branch office or from the Parts Depot in Philadelphia.

**Training of your instrument men** in up-to-date maintenance methods at the tuition-free Honeywell Education and Training Center in Philadelphia.

These are but some of the benefits you gain when you add your company's name to the list of prominent companies using Honeywell instrumentation. Get the full story from your nearby Honeywell sales engineer. He's as near as your phone.

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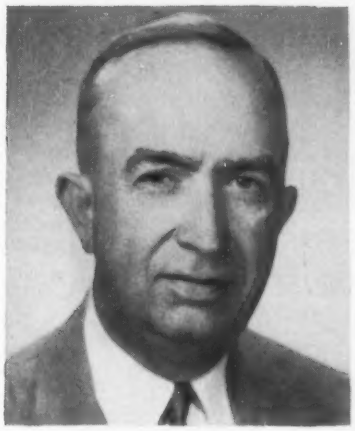
BROWN INSTRUMENTS
*First in Controls*



# Kurth Becomes Boston Ed VP

Henry R. Kurth has been elected vice president and director of electric and steam operations for Boston Edison Co. He succeeds H. W. H. Wellington, who continues as a vice president in addition to his new post as assistant to the president.

Kurth has been associated with Boston Edison in various technical positions since he received his electrical engineering degree in 1921 from Massachusetts Institute of Technology. He served as assistant chief of electrical operations, production department, for a number of years, and in 1943 was appointed chief of electrical operations. Since 1952 he has been assistant vice president and superintendent of the production and system dispatching departments.

**HENRY R. KURTH**

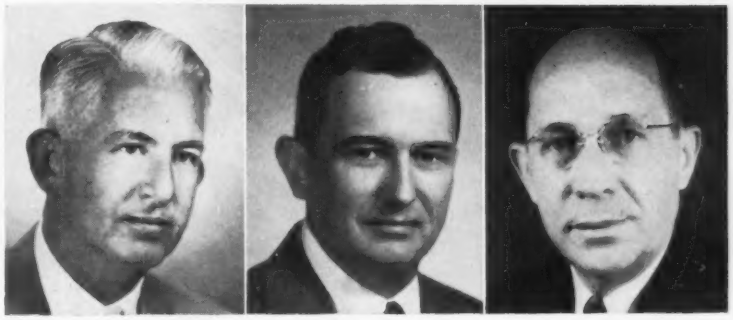
# EEI Names Three Executive Committee Heads

Edison Electric Institute has appointed Theodore O. McQuiston, Robert G. Schneider, and C. W. Franklin to chairmanships of three executive committees for the administrative year 1956-57.

McQuiston, vice president-general sales manager of Metropolitan Edison Co and residential and commercial sales manager of Pennsylvania Electric Co, will head the Commercial Division executive committee. A veteran of 31 years in the utility field and active in numerous industry associations, he will direct the coordination of activities of the 20 commercial committees.

Schneider, assistant treasurer of Virginia Electric & Power Co, is new chairman of the Accounting Division executive committee. He has been with VEPCO since 1922 and has been active in the EEI Accounting Division for a number of years. He now heads the committee responsible for general supervision over activities of the other 13 division committees.

Franklin becomes chairman of the Engineering and Operating Division executive committee, coordinating agency for activities of the other five division committees. He has been electrical engineer of Consolidated Edison Co since 1940, and has served in its construction, operating, and engineering departments since he joined the utility in 1915.



**THEODORE O. McQUISTON ROBERT G. SCHNEIDER C. W. FRANKLIN**

# Ford Gets Manager's Post

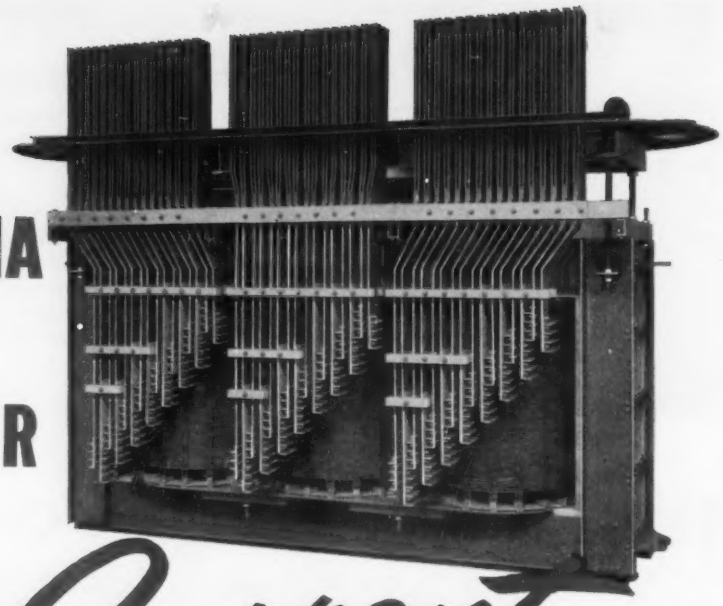
Canadian Utilities, Ltd, of Edmonton, Alberta, has announced the recent appointment of J. N. Ford to the position of manager of operations for the utility.

A graduate of the University of Alberta, where he obtained his Bachelor of Science degree in electrical engineering in 1934, Ford has held the post of chief electrical engineer for Canadian Utilities for the past five years. He is an active member of the Engineering Institute of Canada and the Association of Professional Engineers of Alberta.

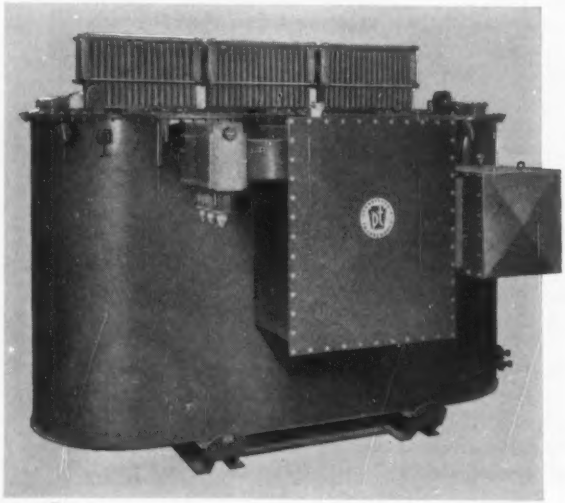
**J. N. FORD**

(*More News About People on page* 41)

# Does this PENNSYLVANIA FURNACE TRANSFORMER set a *High Current Record?*



Investigation seems to indicate that it does — but record or not, the 82,000-ampere low voltage line current for which the unit is designed definitely is one of the highest current ratings ever provided for a furnace transformer in this country.



This extremely high current can be delivered at the future transformer rating of 21,300 kva. Now rated at 16,000 kva (with a maximum L.V. line current of 61,600 amperes), the three-phase unit has provisions for the addition of forced-oil cooling equipment to supplement the present water cooling and achieve the higher kva rating.

The transformer has a high voltage rating of 13,200 delta volts, and a low voltage rating of 250 delta volts with a full-capacity tap range in 10-volt steps down to 150 volts. The high L.V. line current results from the high kva and the fact that the lowest low voltage tap is at full capacity. The various low voltages are accomplished by means of a motor-operated, remote-controlled tap changer in the H.V. winding.

Pennsylvania now has designed and built furnace transformers ranging from 250 through 25,000 kva, and from 3175 through 82,000 amperes. Why not put this furnace transformer know-how and experience to work for you?

**PENNSYLVANIA TRANSFORMER COMPANY**

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

# Zinsmeister is Advanced to President

Newly elected president of Pittsburgh Reflector Co is Robert C. Zinsmeister, previously plant manager of the company's Irwin, Pa., plant.

Zinsmeister, who will make his headquarters at the Pittsburgh executive offices, has been associated with the firm since 1945, when he joined the purchasing department. In 1949 he was named purchasing agent, and subsequently became assistant secretary and treasurer. He was elected to the board of directors in 1953.

In another company appointment, Donald J. O'Neil was named assistant secretary and assistant treasurer. Since he began his association with Pittsburgh Reflector eight years ago, O'Neil has served as cost accountant and assistant to the executive vice president.

ROBERT C. ZINSMEISTER

## PERSONAL BRIEFS

Recently promoted by Virginia Electric & Power Co were **George A. Upchurch,** who succeeds **G. Ralph Breeding** as rural engineer, Suffolk area; Breeding transfers to Clifton Forge area; **Rex B. Springston,** rural representative in Roanoke Rapids area, replacing Upchurch; **Ralph W. McNinch** as rural engineer for Williamston area to succeed **James H. McBrayer, Jr,** who moves to the Harrisonburg (Va.) office; **John R. Richardson,** rural representative to Fredericksburg area; and **Thomas W. Stuckey** as rural representative, Richmond territory.

Retirements of **Harvey Klumb,** superintendent of electric operation and planning, and **Arthur C. Rissberger,** manager of employee relations, have been announced by Rochester Gas & Electric Co.

Pacific Gas & Electric Co has appointed **Stanley B. Barton,** now manager of the company's valuation department, as assistant manager of the land department. He will succeed **B. K. Dunshee** as manager upon the latter's retirement Jan. 1. Replacing Barton is **Emil J. Lage.**

**Lance H. Whittacker** replaces **James McKeachie** as public information director of British Columbia Power Commission . . . Salt River Power District has named **Howard Tyler** superintendent and **R. D. Johnson** assistant superintendent of Agua Fria steam power plant; and **Don Squire** superintendent and **Bernard Bird** assistant superintendent of Kyrene steam plant.

**R. H. Jackson** has been advanced from district product sales manager to acting manager of used industry sales for General Electric Co's Southeastern district. He replaces Carter L. Redd, new commercial vice president for the Southeast district.

Republic Steel Corp has announced the appointment of **Earle C. Smith** as director of research in addition to his present duties as chief metallurgist . . . **Lester N. Dukelow** is new manager of sales for High Strength Steel Division of Republic.

The Atomic Energy Division of Sylvania Electric Products, Inc. has named **Emerson S. Norris** as manager of facilities engineering.

Philco Corp Appliance Division has elected **Harold W. Schaefer** vice president and general manager, succeeding **Raymond A. Rich,** who has resigned.

Federal Telephone and Radio Co has promoted **Richard C. Hess,** formerly sales engineer, to sales manager.

**James A. Curl** has been elected vice president of operations control, RCA Victor Distributing Corp. . . . New director of service engineering for Cornell-Dubilier Electric Corp is **William Ashby.**

**Robert P. Dedlow,** former New York district service engineer for Western Precipitation Corp, has been appointed project engineer for design, fabrication, and installation of a new Western Precipitation system at the United States Steel Corp's Homestead Works.

**William P. Hemp** has been upped to assistant sales manager of tape products for Minnesota Mining & Manufacturing Co's International Division.

**Kirby F. Thornton,** formerly chief engineer for New Kensington Division of Aluminum Company of America, has been named assistant manager of its Sales Development Division, New Kensington, Pa.

University of Dayton has announced the appointment of **Perry A. Borden,** formerly patent engineer for The Bristol Co, as associate professor of electrical engineering.

**Marvin C. Bonine** has joined Federal Pacific Electric Co as manufacturing manager for the Pacific Switchgear Division . . . J. H. Holan Corp has named **John Kott, Jr,** sales manager.

## OBITUARY

**Thomas C. Dee,** 62, formerly a superintendent of transmission and distribution at Ohio Edison Co, succumbed recently to a heart ailment. Dee, who retired in 1953, had been associated with Ohio Edison for 24 years.

**Lynden W. Cross,** 51, supervisor of instrumentation and controls in Rochester Gas & Electric Corp's steam generating plants, died recently.

**Thomas I. Phillips,** 69, retired vice president of Westinghouse Electric Corp, died recently.

ADVERTISEMENT

## Highlights in development of pvc compounds for wire and cable

1932. Experimental work began.

1935. First commercial production, principally for signal and instrument wiring.

1938. Underwriters' approval in appliance lead wires.

1930-40. Underwriters' approval as Type T wire for rewiring jobs.

WORLD WAR II YEARS. Military applications: communications, power, electronics, signalling and others (including aircraft and shipboard);

Code recognition for use as Type T wire for new installations;

Underwriters' approval (1943) and NEC recognition as Type TW for wiring in wet locations.

1946-48. New applications and approvals: machine tool wiring, switchboard wiring, street lighting cable, cords, control cable, and many others.

1951. Acceptance by IMSA for police and fire alarm cable NEC recognition as TW wire through 2000 MCM; Underwriters' approval of Rome Synthinol 901 for 105°C. appliance wiring and, in

1954, approximately 100 million pounds of polyvinyl chloride compounds were used by the wire and cable industry.

CURRENT TRENDS

No. 4 in a series of articles

# Progress report on polyvinyl chloride insulations

Since 1932, when researchers started investigating polyvinyl chloride compounds for wire and cable, it has become one of the most popular insulating materials available. In fact, over 100 million pounds were used by the wire and cable industry in 1954 alone!

To bring you up to date on polyvinyl chloride wire coatings and Rome Cable's product—Rome Synthinol® in particular, is the purpose of this brief report.

### What are polyvinyl chloride compounds?

These compounds consist of polyvinyl chloride (or a co-polymer of polyvinyl chloride and polyvinyl acetate) thermoplastic resin mixed with plasticizers for flexibility, fillers for strength, pigments for color, and stabilizers for resistance to age and oxidation. The combined properties of these ingredients determine the properties of the compound. The compounds are thermoplastic in that they do not require vulcanization. They are generally applied to wire by the extrusion process.

Polyvinyl chloride compounds produced by Rome Cable bear the registered trade name Rome Synthinol®.

### Characteristics of Rome Synthinol

Rome Synthinol has earned its popularity because of these desirable characteristics:

*Economy*—low in cost; and because of its small diameters, handling and installation costs are minimized

*Simplicity*—no outer braids required

*Flame Resistance*—inherently resists burning

*High Dielectric Strength*—higher than most rubber compounds

*Moisture Resistance*—superior to many rubber compounds

*Appearance*—bright, shiny colors

*Weather Resistance*—unaffected by long exposure to sunlight and weather

*Versatility*—suited to many low-voltage insulation and jacket applications—indoors or out, in conduit or duct, in water, or in the ground

### Special compounds

Because polyvinyl chloride insulation and jackets derive their properties from the materials they contain, it is possible—through proper ingredient selection—to "engineer" compounds for specific end uses. Here are some of the special applications:

*Cold*—special compounds are available for low-temperature applications—down to 40°C. and lower

*Heat*—special compounds are available for high-ambient conditions—up to 105°C.

*Deformation*—special compounds, or special cable design, can reduce this effect

*Moisture*—most polyvinyl chloride compounds have very good moisture resistance. But careful selection is advised if dc potentials are involved in wet locations.

Polyvinyl chloride insulation should not be used where heavy and/or frequent current overloads are involved (such as in network cable). And because of relatively higher dielectric losses, it is not generally recommended for the higher primary distribution voltages.

### Specifications

The various polyvinyl chloride wire and cable industry specifications in use today are: Underwriters' Specifications; ASTM D734; IPCEA Appendix I for insulation, Appendix J for sheath; Federal Specification JC-129; IMSA Specification No. 20.

There are also, of course, many individual customer specifications applicable for specific end uses.

### Typical applications

Rome Synthinol and other polyvinyl chloride materials are suited for these wire and cable applications:

Type TW building wire
Nonmetallic sheathed cable
Type UF underground feeder cable
Machine tool wire
Station control cable
Series street lighting cable
Multiple street lighting cable
Multiple conductor instrument wiring
Fire alarm and traffic signal cable
Over-all jackets
Fixture wires
Radio hook-up wire
Appliance wires

### Further developments

From its active and pioneering part in the development of polyvinyl chloride compounds, Rome Cable's experience is reflected in Rome Synthinol Cables. Special Rome Synthinol Compounds are available for many unusual applications.

A notable example is Rome Synthinol 901, the first high-temperature polyvinyl compound to receive appliance wire listing for 105°C., and later approved for use on TW moisture-resistant building wire. Because of other outstanding properties—increased resistance to oils, solvents, and chemicals—Synthinol 901 has proved itself as a preferred insulation material for chemical, petroleum, and other industrial wiring where high temperatures and environmental hazards are a continuous problem.

If you have a wire and cable problem for which a polyvinyl chloride compound might provide the answer, our experience is at your service.

**ROME CABLE CORPORATION, Rome, New York**

# MEETINGS CALENDAR

## OCTOBER

**Interstate Power Club**—Hotel Martinique, New York, N. Y., October 8.

**American Society of Mechanical Engineers**—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Chalfonte-Haddon Hall, Atlantic City, N. J., Oct. 8-10.

• **National Academy of Sciences—National Research Council**—25th Annual Conference on Electrical Insulation, General Electric Research Laboratory, Schenectady, New York, October 8-10.

**American Welding Society**—National Fall Meeting, Hotel Cleveland, Cleveland, Ohio, Oct. 8-12.

**Pennsylvania Electric Association**—Systems Operation Committee, Penn Alto Hotel, Altoona, Pa., Oct. 10-11; Meter Committee, Split Rock Lodge, White Haven, Pa., Oct. 18-19; Prime Movers, Garden City Hotel, Garden City, N. Y., Oct. 18-19; Communications Committee, Fort Stanwix Hotel, Johnstown, Pa., Oct. 22-23; Relay Committee, Hotel Robert Treat, Newark, N. J., Oct. 25-26.

**Southeastern Electric Exchange**—Accounting Meeting, Hotel Seville, Miami, Fla., Oct. 10-11.

**Great Lakes Power Club**—Fall Meeting, Durant Hotel, Flint, Michigan, Oct. 11-12.

• **Edison Electric Institute**—Electrical Equipment Committee, Hotel Statler, Cleveland, Ohio, Oct. 15-16; Transmission and Distribution Committee, Hotel Statler, Buffalo, N. Y., Oct. 18-19; Electric Space Heating & Air Conditioning, Indianapolis, Indiana, Oct. 25-26; Wiring Promotion Committee, Cherry Hill Inn, Haddonfield, N. J., Oct. 29-30.

**Inter-Industry Farm Electric Utilization Council** — National Power Use Workshop, Milwaukee Auditorium, Milwaukee, Wis., Oct. 15-16.

**Iowa Utilities Association**—Annual Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 15-16.

• **American Society of Civil Engineers**—Annual Convention, Penn-Sheraton Hotel (formerly Hotel Wm. Penn), Pittsburgh, Pa., Oct. 15-19.

**Michigan Municipal Utilities Association**—Park Place Hotel, Traverse City, Mich., Oct. 17-18.

**Wisconsin Utilities Association**—Annual Convention of Electric & Gas and Operating & Sales Sections, Schroeder Hotel, Milwaukee, Wis., Oct. 17-19.

**American Institute of Electrical Engineers**—Electrification of Machine Tools Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, Oct. 22-24; Farm Electrification Conference, Hotel Peabody, Memphis, Tenn., Oct. 29-31.

**American Standards Association**—38th Annual Meeting and 7th National Conference on Standards, Hotel Roosevelt, New York, Oct. 22-24.

**University of Texas**—Ninth Power Distribution Conference, University Batts Auditorium, Austin, Tex., Oct. 22-24.

**National Safety Council**—44th National Safety Congress & Exposition, Chicago, Illinois, Oct. 22-26.

**National Association of Corrosion Engineers**—South Central Region Meeting, M & M Building, Houston, Texas, October 23-26.

**Oklahoma Utilities Association**—Electric Light & Power Division, Western District, Chickasha, Okla., Oct. 25; Eastern District, Poteau, Okla., Oct. 26.

**Northwest Public Power Association**—Power Use Section, Franklin PUD Auditorium, Pasco, Wash., Oct. 25-26.

**Montana State Rural Electric Cooperative Association**—Annual Meeting, Lewiston, Mont., Oct. 29-31.

**Industrial Management Society**—Hotel Sherman, Chicago, Ill., Oct. 31-Nov. 2.

## NOVEMBER

**Pennsylvania Electric Association**—Transmission and Distribution, Shenango Inn, Sharon, Pa., Nov. 1-2.

• **Edison Electric Institute**—Sales Personnel & Training Committee, New York, N. Y., Nov. 2; Commercial Lighting Committee, Shoreham Hotel, Wash., D. C., Nov. 8-9; Industrial Relations Committee, EEI Headquarters, New York, N. Y., Nov. 15; Industrial Power & Heating Group, Detroit, Mich., Nov. 15-16; Accident Prevention Committee, Statler Hotel, Hartford, Conn., Nov. 26-28.

**National Rural Electrification Cooperative**—Region Nine Annual Meeting, Davenport Hotel, Spokane, Wash., Nov. 12-13.

**National Electrical Manufacturers Association**—Annual Meeting, Traymore Hotel, Atlantic City, New Jersey, Nov. 12-16.

**Pacific Coast Electrical Association, Inc**—Administrative Services Section, Hotel Biltmore, Santa Barbara, Calif., Nov. 14-15.

**American Society of Refrigerating Engineers**—43rd Semi-annual Meeting, Hotel Statler, Boston, Mass., Nov. 25-28.

**American Society of Mechanical Engineers**—22nd National Exposition of Power and Mechanical Engineering, Coliseum, New York, N. Y., Nov. 26-30.

**Great Lakes Conference of Railroad and Utilities Commissioners**—First Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 29-30.

## DECEMBER

**Institute of Radio Engineers**—2nd Instrumentation Conference, Biltmore Hotel, Atlanta, Ga., Dec. 5-7.

• **Edison Electric Institute**—1957 Conference Planning Committee, sponsored jointly with American Gas Association, EEI-AGA Headquarters, New York, Dec. 6-7; Street Lighting Committee, Dayton, Ohio, Dec. 6-7; Commercial Cooking & Water Heating Committee, Cleveland, Ohio, Dec. 13-14.

## JANUARY, 1957

• **American Institute of Electrical Engineers**—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

• **Doble Engineering Co**—24th Annual Conference of Doble Clients, Sheraton Plaza Hotel, Boston, Massachusetts, January 14-18.

• **Missouri Valley Electric Association**—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

## FEBRUARY

• **National Association of Purchasing Agents**—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

• **Electric Institute of Washington**—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., February 12-14.

• **American Society of Heating and Air-Conditioning Engineers**—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

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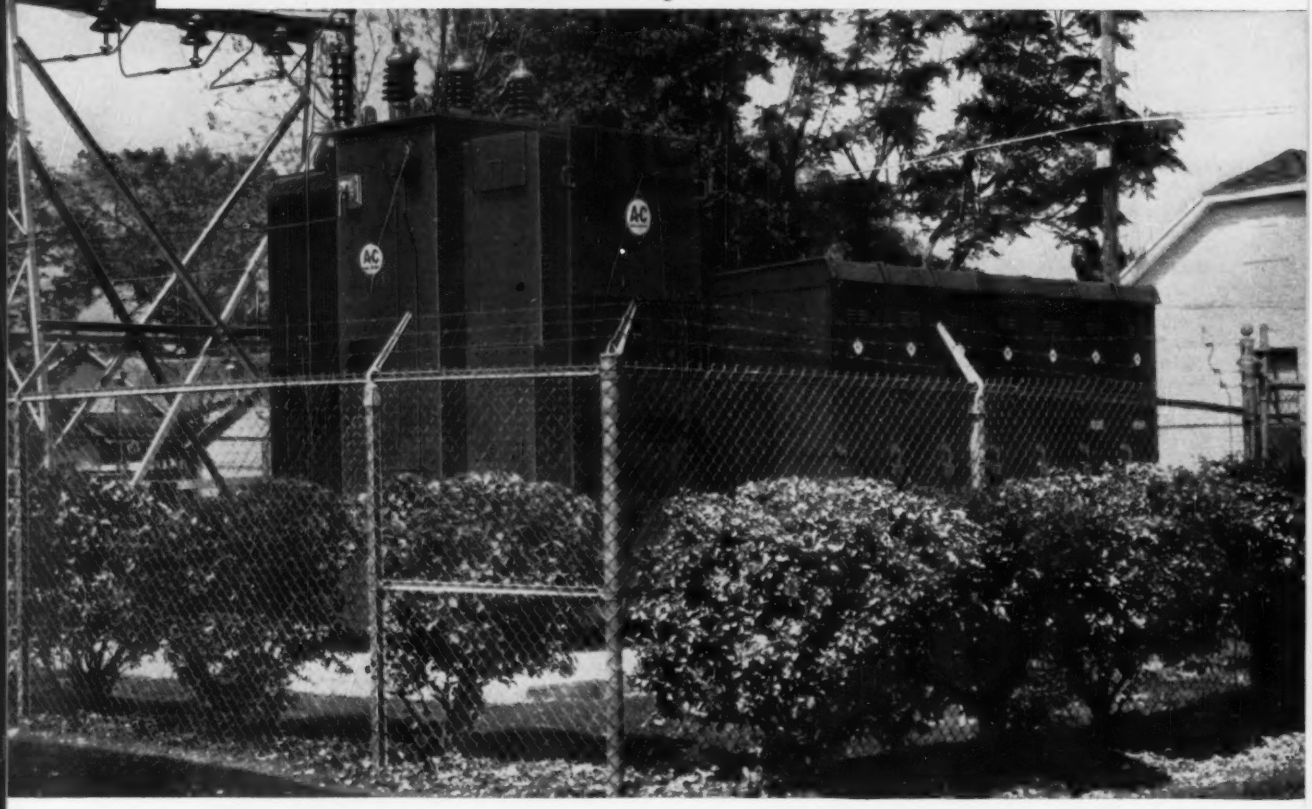
• Additions this week.

# Allis-Chalmers . . . the Modern Look



## Allis-Chalmers unit-subs offer a 3-way

# Safety - Convenience

**Safety—**
Further improve your high safety standards with such features as:

- Mounting of potential and control transformers on drawout carriages for complete isolation of primary and secondary contacts during inspection.
- Automatic, positive-acting shutters to isolate high voltage contacts when breaker is withdrawn . . . *not dependent on springs or gravity.*
- Complete steel barrier compartmentation, flame retardent insulation, and safety interlocks.

**Convenience—**
Here's a typical convenience extra found in all types of Allis-Chalmers switchgear. You can move breaker to test, or even fully disconnected position inside cubicle . . . *and still close the door.* No special storage space is required for breakers not in use . . . handling is reduced.

# ALLIS-

# in Unit Substations

## answer to your system growth problems

# - Versatility

**Versatility—**

You can build *today* with an eye to the *future* with Allis-Chalmers standardized construction:

- Additional circuits may be added easily due to grouped control wiring . . . dry bus joint . . . jig-built construction.
- Transformers of larger capacity may be substituted without changing throats.
- Current transformers with higher ratios can be substituted. All have same mounting dimensions.
- Major components are interchangeable.

**In addition,** there's ease of installation, and extra reliability built into Allis-Chalmers switchgear. For the answer to your system growth problems, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

# CHALMERS

A-C ALLIS-CHALMERS

A-5147

# NEW Chance Type H1 Vertical-Break Switches

## Rotating stack...group operated...
## 7.5 through 69 KV — 400 — 600 — 1200 amps

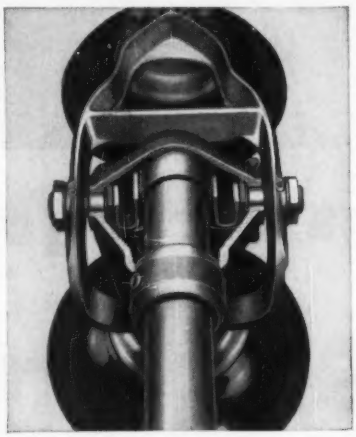
The design requirement for this new Chance Type H1 Vertical-Break Switch was to "give it everything, but keep it simple." The most critical engineer will agree that this has been accomplished in the new H1, that completes the most modern line of braidless switches—the Chance S (Side Break) the C (Center Break) and H (Vertical Break).

This design simplicity brings you a switch that is exceptionally easy to install and easy to operate, yet incorporates all the features power men want for substation and pole top switching. Features like:

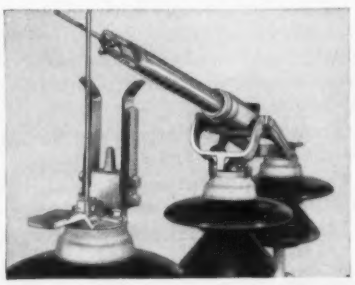
- Silver to copper, self-wiping, high pressure, adjustable jaw contacts. Silver contact bars are brazed on the blade end.
- Silver to copper, sealed hinged contacts maintain continuous contact through complete operating cycle.
- Only 3 moving parts... for years of dependable performance in any kind of weather.
- Blade closes with rotating motion that makes clean, high pressure contact ...breaks ice formations with ease.
- Sealed main bearing assembly for continuous smooth operation.
- Coin-silver bars brazed on blade tip for positive current transfer.
- Braidless current path with sealed hinge contact and silver-to-copper jaw contacts.
- Field adjustments, if necessary, can be made without special tools.
- All parts easily accessible.

New Chance Type H1 Vertical-Break Switches meet NEMA and AIEE requirements.

CS56-22



*Cutaway view of hinge mechanism:* Hinge contacts remain completely enclosed at all times ...protected from oxidation and corrosion. Pressure springs are beryllium copper.



Brazed-on silver contact bars extend from the switch blade to give lifelong positive contact.

*To get your copy of the H1 Bulletin write:*

ABC INDUSTRIES

**A·B·CHANCE CO.**

General Offices: Centralia, Missouri

This 86-Year-Old House . . .

Gets Rochester G&E Revamping as . . .

# First Round Is Won in Slum Fight

After Rochester Gas & Electric Corp finished remodeling the bungalow shown above, a month-long open house drew a big turnout and wide attention. But the important after-effect—the response of homeowners in the neighborhood—has been the exciting topic for city leaders.

"The reaction has been overwhelming," said Gaston L. Breckenridge, RG&E's Architect and Builders Bureau supervisor. "At least three major remodeling jobs in the neighborhood followed the open house. And about 25 homeowners have finished smaller fix-up projects," he said. The same cycle is happening in other areas where builders have remodeled.

Breckenridge, the utility's representative in Rochester's Home Builders Association, said the project proved to local property owners that old neighborhoods can be revitalized. Many of the residents near the remodeled home changed their minds about moving to the suburbs, he said. And the open house helped change the thinking of landlords who had been dragging their feet as far as modernization was concerned.

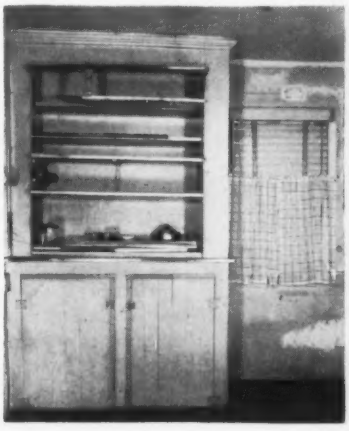
The city enacted compulsory repair legislation last February to upgrade substandard sections. RG&E's project has produced a welcomed dividend by encouraging compliance with the law by suggestion, not pressure.

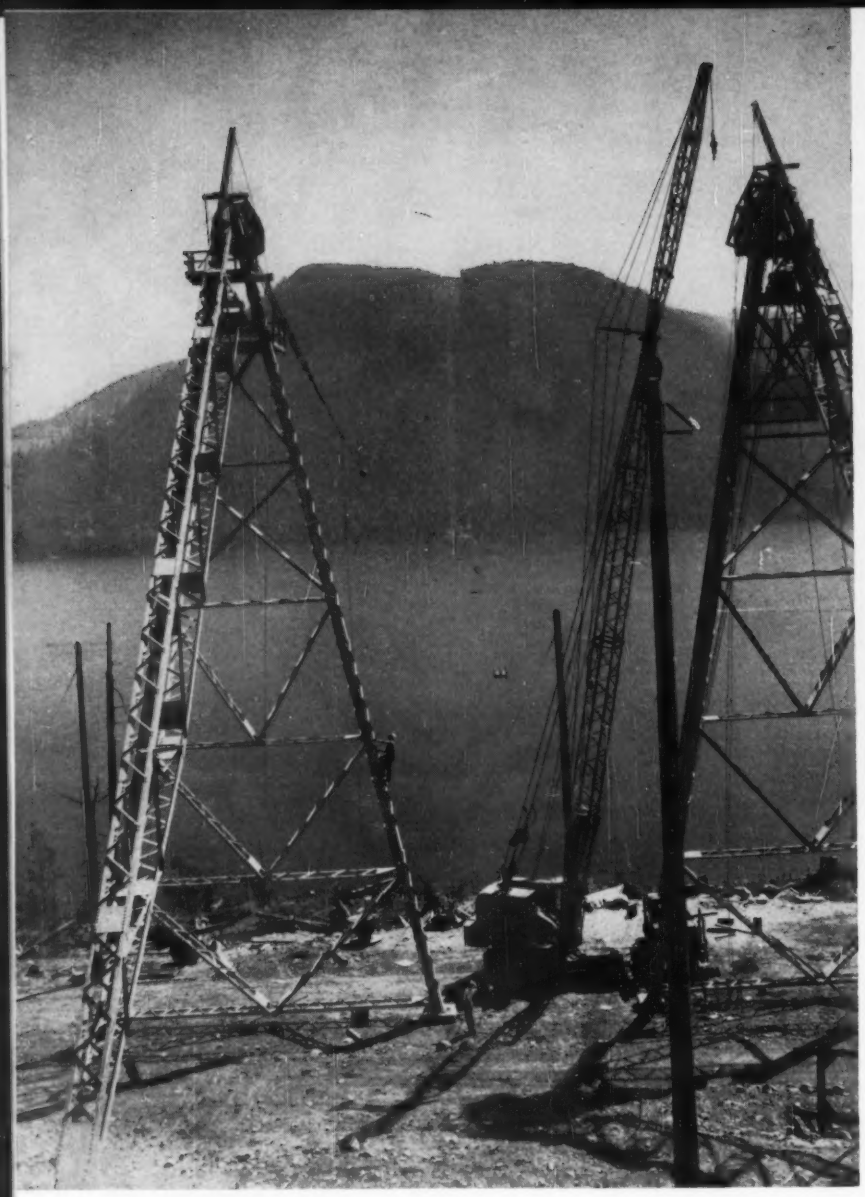
The remodeling idea got its start in 1954 when Rochester's 350 members of the Home Builders Association agreed something had to be done about rehabilitation. Their plan: Assume responsibility themselves of modernizing some borderline homes.

RG&E led the way by buying for $4,500 a structurally sound but dilapidated, house built in 1870. Architects and contractors did such a good job the utility got more than 25 offers to buy the place, one for $14,200, after 15,000 people visited the Housepowered home. RG&E's cost, including purchase price, was $11,131. The house will be sold at cost.

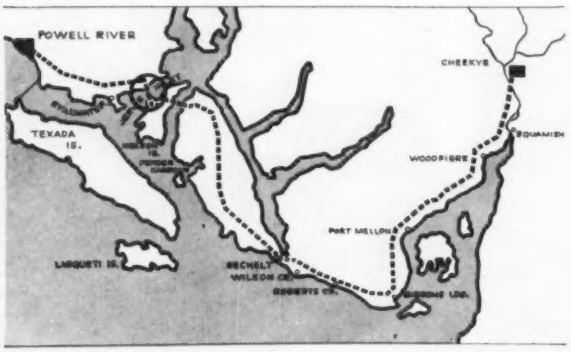
Heartened by the project's success, RG&E plans to buy and modernize another run-down home soon. The remodeling jobs are a natural, the company feels, for achieving its interests in community service and adding value to existing distribution lines.

**Neighbors who saw this "before" and "after" transformation followed suit with their own modernizations**





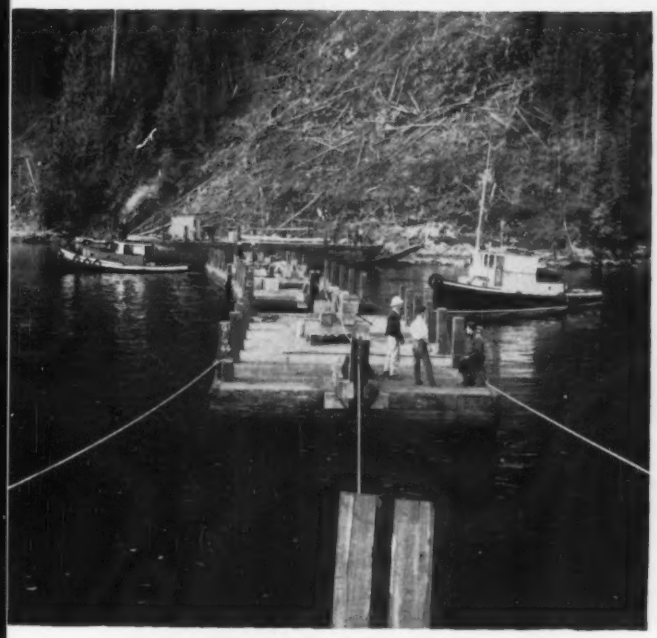
• Three aluminum-coated, steel-cored, 1¼-in. cables now span the 10,100-ft width of Jervis Inlet




# BC Electric Spans

The world's fourth longest overhead shore-to-shore electrical transmission system has been completed across Jervis Inlet in British Columbia by BC Electric Co. The 10,100-ft triple span is part of a 100-mi, 132-kv link from Vancouver to the pulp and paper town of Powell River. The line was energized last week.

Termed a "major engineering feat," the one-week crossing required surveys which permitted an error of not more than 1 ft in 10,000. Starting at Nelson Island, cables were connected to 45-ft towers and payed out by a special barge. The crew used scows as work platforms at 1,650 ft



• Starting at Nelson Island towers, cables were payed out on special barge to crews working on scows spaced at 1,650-ft intervals

• Conductor has minimum breaking strength of 260,000 psi. Main strands were socketed and pre-stretched under tension of 115,000

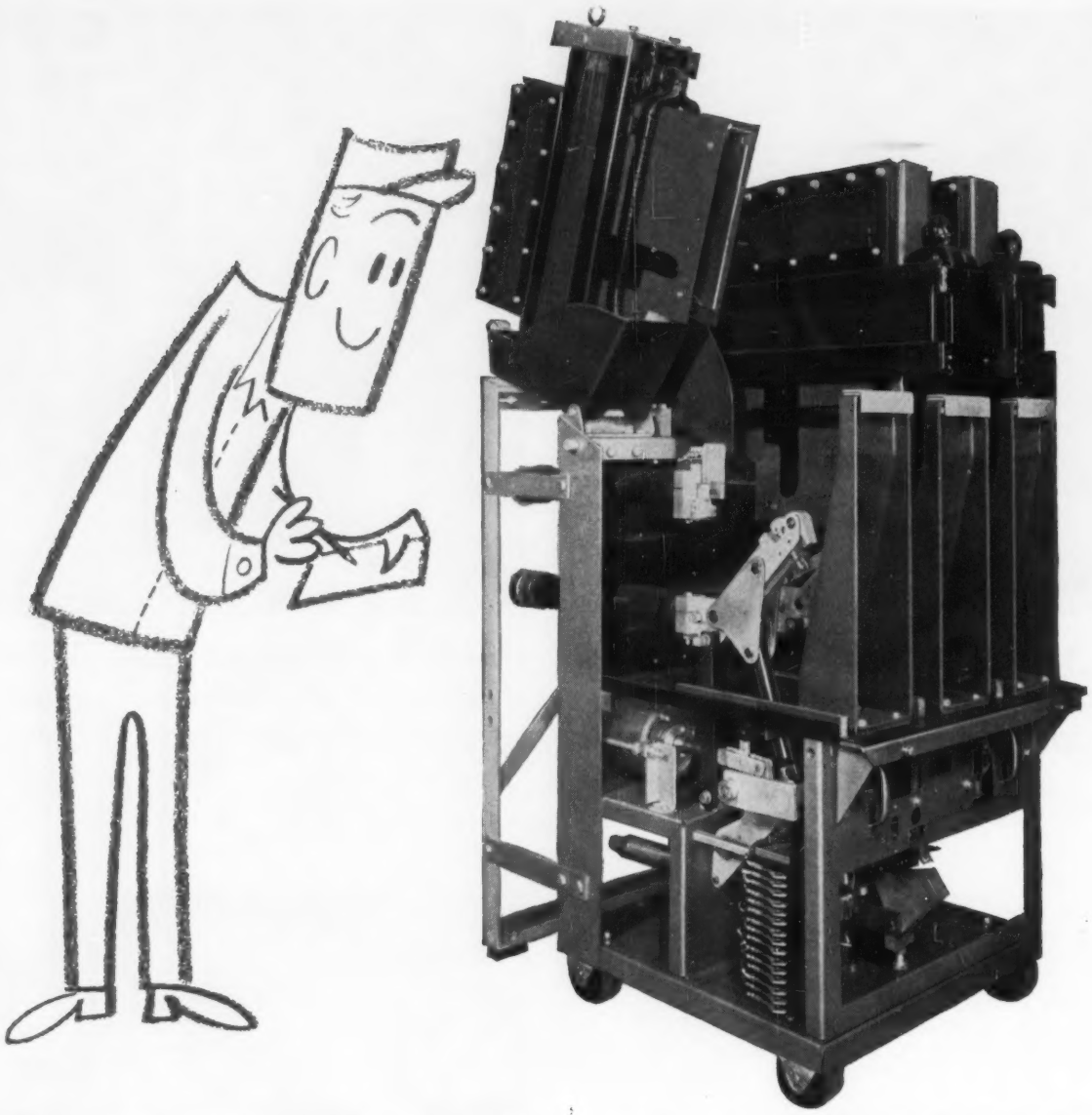
• Cables dip to 200 ft above water at lowest point. Two-ft diameter, orange aluminum spheres warn aircraft

# Inlet Via Barge

intervals to support the cable. At the north end, cable was hooked to a 30-ton winch and hauled 600 ft up to 90-ft towers on the mainland.

To hold the tension of 54 tons of cable, mainland towers have 36-ft bases with 85-ft spread from front legs to back. They are designed to take 12,800-lb vertical loading plus 95,400-lb horizontal tension. A 25-ton crane did the work on the mainland and a ¾-yd crawler handled the island towers.

Cost for the Jervis Inlet span, handled by B.C. Engineering Co, Ltd, is $600,000, a part of an overall $5 million transmission project.



# SEE VALUE HERE YOU'LL SEE NOWHERE ELSE

Operating engineers in the electrical industry often say you can see the higher quality in I-T-E switchgear even when you stand 'way back.

Of course, they're only partly right. You can easily see the practical component arrangement, the all-welded steel construction with compartments designed to retain shape even when lifted as a unit, and the clean, neat appearance. These are standard on all I-T-E switchgear.

But we want you to look closer—see even more. For example, in Metal-Clad Switchgear: the easy-to-service horizontal drawout design; the tilting arc chutes; the extra-heavy insulation. There's quality in every detail—quality that means dollars' more value for your switchgear investment and years' longer troublefree service.

Why not phone the I-T-E office nearest you. Or write for bulletin 7004 giving a complete description of 5, 7.5 and 15 kv switchgear. I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E

**I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division**

## First Housepower Winner Collects

Mrs. H. V. King, Talladega, Ala. housewife, is the first monthly prize winner of the nationwide $100,000 Housepower contest sponsored by Edison Electric Institute. Her reward: a color TV set and a bonus. She's being congratulated by E. O. Hussey, Alabama Power Co district manager. Robert Rutledge, manager, Rutledge Radio & Appliance Co and Karl Platt, right, district manager, Watts-Newsome, Philco Corp distributors, look on. Winner for June was Mrs. O. O. Thomas, Bozeman, Mont., customer of Montana Power Co. Mr. Arthur Shay, Des Plaines, Ill., scored in July. He's on the lines of Public Service Co, a subsidiary of Commonwealth Edison Co. Both won color TV sets. The contest, which ended Sept. 30, drew more than 300,000 entries. The winner of the $10,000 grand prize will be announced soon.

### S & S SHORTS

**Outdoor Ads Go Hi-Fli**

Program to use hi-fluorescent lighting on all General Outdoor Advertising Co poster panels has been announced by the company. Created to increase impact of 24-sheet posters, system uses two 8-ft General Electric Co tubes mounted 2 ft apart on each poster panel. Lamps are fitted into special reflector design. Light output is said to be two to three times more than filaments. Life is 7,500 hr compared with 1,000 hr for old type.

**Who Owns Dishwashers?**

Survey by Hotpoint Co reveals these items about typical automatic dishwasher owner: Lives in town of at least 10,000 population; owns own home; arranged for own installation; paid under $50 to install it; and bought it to save time and work. Hotpoint's marketing studies show there's a potential mobile dishwasher market of 26-million customers — 14-million home and apartment renters, 12-million home owners.

## LBE Woos Dealers

### Here are 8 promotional ideas to help the utility step up dealer effectiveness

Cash registers of U. S. dealers can play a healthy tune this fall and in the years ahead. The ring will be healthier than ever if retailers, on their own initiative, tie in with an eight-point Live Better . . . Electrically program.

This is the prediction of R. E. Ingmire, an LBE staff member. He described this checklist for greater profits at the recent Milwaukee, Wis., regional meeting of National Appliance & Radio-TV Dealers Assn:

**1.** Use LBE theme and symbol in regular advertising campaigns and in special concentrated efforts, like price specials designed to clean out existing inventories.

**2.** Watch for LBE promotional aids that will be developed as program advances and adapt them to local use; create original variations of electrical-living theme.

**3.** Time in-store promotions to coincide with the twice-a-year LBE retail campaigns.

**4.** Schedule a regular, ever-fresh series of window displays (EW, Sept. 24, p 55) keyed to the LBE consumer brochure.

**5.** Use LBE open-middle or open-end radio and TV musical commercials.

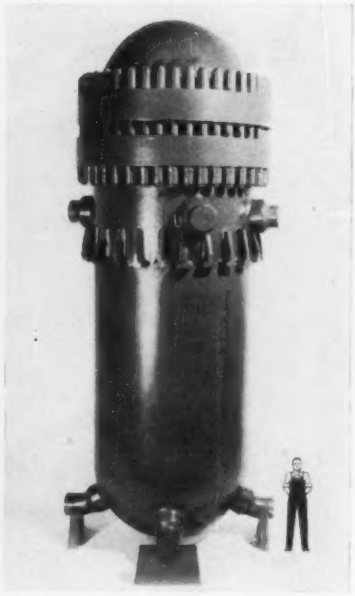
**6.** Gain LBE and good living identity by featuring LBE theme on trucks.

**7.** Advertise strongly in special newspaper supplements and sections.

**8.** Hold regular Electric Weeks or months—an idea that improves with repetition.

Utilities would do well to sell all eight suggestions to their dealers as a means of strengthening retail sales efforts. The LBE concept has the complete endorsement of NARDA's President Don Gabbert. "As I see it," says Gabbert, "dealers and distributors will be the first to feel increased demand."

Ingmire pointed out to NARDA members that over 300 electric utility companies "who run the show" are spearheading the LBE program. Over 27 associations and 39 major manufacturers are supporting the campaign, he added.



# C-E Ships First Commercial Reactor Shell

Combustion Engineering, Inc, Chattanooga, Tenn., has shipped the 150-ton shell for America's first nuclear reactor for commercial electric power. The shell, with its head fastened, forms a 235-ton reactor vessel reportedly the heaviest unit of atomic power equipment manufactured to date.

In the left hand illustration, the reactor shell is shown on its side on a specially built flatcar. At right is a picture of a model of the reactor vessel, with a 5 ft 10 in. man drawn beside it to give an idea of its size.

The reactor was built for the atomic power plant at Shippingport, Pa., which Westinghouse Electric Corp designed under contract with the Atomic Energy Commission. The plant will be operated by Duquesne Light Co. It is scheduled to go into service next year with an initial output of 60,000 kw. However, a turbine-generator of 100,000 kw rating will be installed in anticipation of possible greater nuclear capacity in the future.

The reactor vessel required two years to fabricate. It is 32 ft 8 in. high, its steel walls are 8½ in. thick, and its internal diameter is approximately 9 ft. Its top head, weighing some 85 tons, will be delivered after January 1, 1957. The vessel will be closed by means of 42 studs, each 6 in. in diameter and 6 ft long; each stud assembly weighs 700 lb. Internal equipment, including a core and thermal shields, will add another 100 tons.

The shell was rolled in sections and then precision welded. Every joint was checked with a 15,000,000-v Betatron x-ray machine, which is said to be sensitive enough to detect a ⅛ in. length of toothpick embedded in a 10-in. weld deposit. Accuracy was insured by the use of optical tooling techniques.

The shell is being shipped by rail from Chattanooga to Shippingport. The airline distance between these two points is about 365 miles, while the reactor will travel 1,075 miles in moving between them. It is being routed via Bristol, Va., and Hagerstown, Md., on a special 24-wheel flatcar that is 60 ft long and weighs 80 tons.

## NCC Reports on Brushes

National Carbon Co. a division of Union Carbide & Carbon Corp, 100 E. 42 Street, New York 17, N. Y., claims that their Grade N-2 and N-6 specially treated brushes for silicone insulated machines have proven their acceptability. The brushes, it is said, not only have operated with a minimum of wear, but have a more normal contact drop than that which is experienced with conventional brushes operating in a silicone atmosphere.

## Lead Association Moves

Lead Industries Association moved its headquarters to 60 East 42nd St, New York 17, N. Y. Former address was 420 Lexington Ave, New York.

## Westinghouse Gets Order

Westinghouse Electric Corp has received $4-million order for rectifier equipment for Kaiser Aluminum & Chemical Corp. Rectifier transformers and metal-enclosed pumped-rectifier assemblies will provide dc at Kaiser's Ravenswood, W. Va., plant.

(*More M&M on page* 56)

# Super Durabake A NEW FINISH FOR S&C METALCLAD SWITCHGEAR

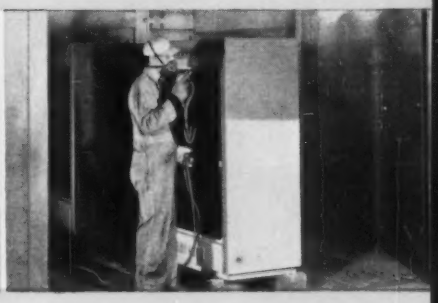
Developed for rigorous outdoor or indoor service, Super Durabake withstands high temperatures, high humidities, blasting effects of wind and sand, and corrosive atmospheres. See below how this tough finish is achieved.

*prevents rust, eliminates maintenance wherever installed*

1 All enclosures are fabricated of scale-free, oxide-free, cold-rolled steel sheets, permitting a smooth, blemishless finish found only on top-grade consumer items.

2 Surfaces to be welded, later inaccessible, receive special preparation which consists of a phosphatizing bath plus an application of metallic zinc.

3 All welds are ground and sanded to remove the scale formed during welding. All internal welds, seams, joints, and splices are wire brushed.



4 The enclosure and all parts are phosphatized. This treatment removes any remaining grease or oil, etches the steel slightly, and forms a neutral, rust-resistant coating.

5 Metallic zinc in alkyd resin is sprayed on all inside and outside surfaces of the enclosure and all parts which are then baked in a huge oven at 300 degrees F.

6 A rust-resistant primer (zinc-chromate-iron oxide) is applied by the spray method to all surfaces. This coat is allowed to air-dry thoroughly before processing continues.

7 The finish coat, of melamine and alkyd resins, is hot-sprayed, permitting an unusually thick, homogeneous coating without runs, sags, or blisters. It is equivalent to a four-coat air-dry finish.

8 All parts are baked at 300 degrees F producing a hard, dense surface required for long life and smart appearance, impossible to achieve with air-dry finishes. Baking is done in an extra-large oven unique in the switchgear industry.

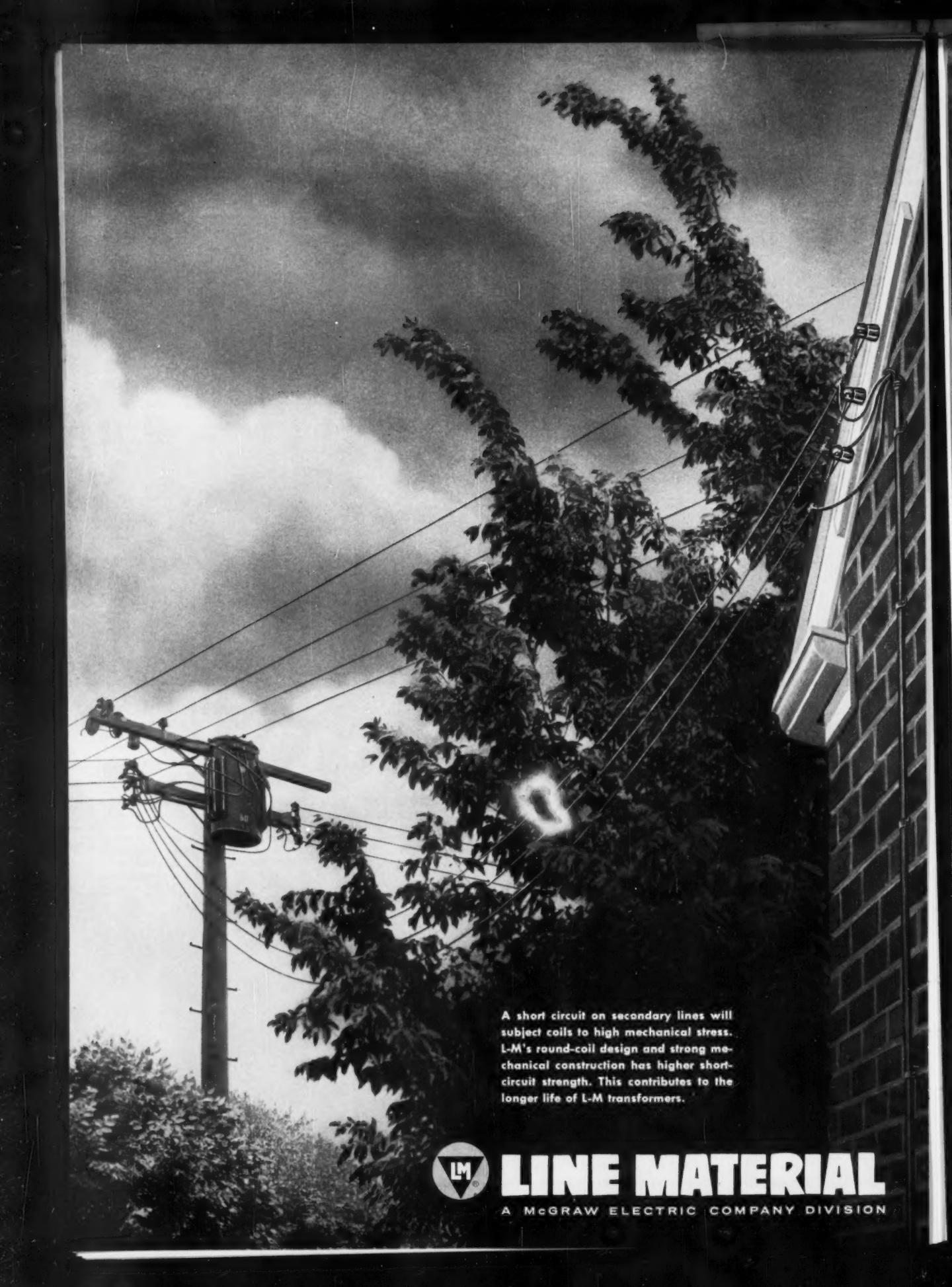
9 For added protection against ground moisture, a thick coat of asphalt paint is applied to the enclosure's bottom perimeter. A heavy coat of "Insulmat," a "no-drip" compound, is applied to the inside surface of the roof to prevent condensation.

S&C

**ELECTRIC COMPANY**

4421 Ravenswood Avenue, Chicago 40, Illinois

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.



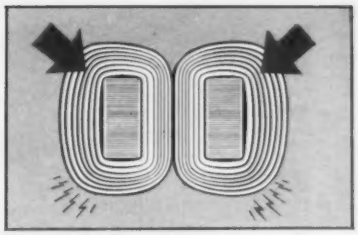
A short circuit on secondary lines will subject coils to high mechanical stress. L-M's round-coil design and strong mechanical construction has higher short-circuit strength. This contributes to the longer life of L-M transformers.

LM

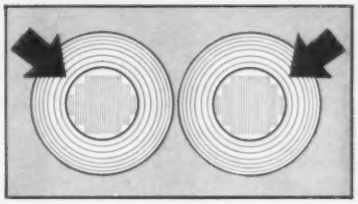
# LINE MATERIAL

A McGRAW ELECTRIC COMPANY DIVISION

Small core-coil assemblies are removed from varnish dip, ready for curing ovens. Varnish is limited to a few outer layers of the coil and a short distance in from the coil ends. This adds mechanical strength, which is achieved while still permitting complete oil impregnation throughout the coil. In large transformers, where forces are greater, core-coil assemblies are completely vacuum-impregnated with varnish.



**Rectangular Coils:** Under short circuits, rectangular coils tend to distort to a round shape; are subjected to insulation damage or even complete failure of the coil.



**Round Coils:** Since the coils on Round-Wound transformers are already round, short-circuit currents produce little or no radial distortion in the coils.

# Here's Why L-M's Round-Coil Design Insures Higher Short-Circuit Strength

## Another big reason why more customers are specifying L-M Round-Wound® Transformers

By **ALBERT C. WURDACK**
Chief Engineer
Large Distribution Transformers
Line Material Company

An important feature of a transformer is its ability to withstand the mechanical forces created by heavy short-circuit currents. The round coils of L-M's Round-Wound transformer and its mechanical construction have an important effect on minimizing these internal stresses.

### Round Coil Design

When rectangular coils are short-circuited, the heavy currents tend to force the windings into circular shape. The coils are therefore subject to physical distortion, which may result in damage to the insulation or even complete failure of the coil.

But round coils, already circular, are not stressed out of shape. The radial forces are distributed evenly with little or no effect on the coil.

### Strong Mechanical Construction

L-M's core clamping structure utilizes rugged formed steel channel and clamping bolts. Sturdy, oil-impregnated maple blocks at top and bottom are tightened and clamped against the coil ends to prevent axial movement.

In addition to strong blocking and clamping, L-M has developed an excellent varnish application. The varnish has high bonding strength to resist short-circuit mechanical shock. It has high resistance to oil, will not dissolve in or contaminate the oil in long-term service. The varnish can be cured at low temperature, avoiding insulation damage.

Thus round coils, plus rugged mechanical construction, give Round-Wound transformers higher short-circuit strength and longer life.

### For More Information

Ask the L-M Field Engineer for more complete information and bulletins on L-M's Round-Wound transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

### Five Reasons Why More Customers Are Selecting L-M Round-Wound Transformers

**1. Higher Uniform Impulse Level:** Round coils are *wound* into shape. Therefore insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

**2. Higher Short-Circuit Strength:** Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

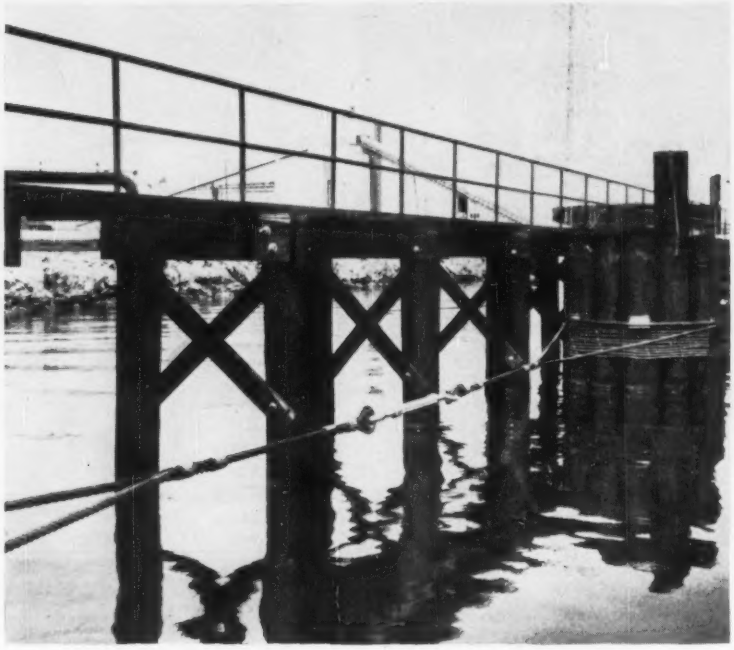
**3. Higher Short-Time Overload Capacity:** Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

**4. Balanced Performance:** The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux path. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

**5. Additional Capacity on Pole:** L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces the bending moment on the pole and crossarms, and thus greatly increases the potential capacity of existing transformer structures.

Transformers



## Wire Rope Supports Pile Clusters

American Chain & Cable, Inc, Wilkes-Barre, Pa., has found another use for its wire rope. American's Tru-Lay preformed wire rope equipped with Dualoc wire rope endings is being used to support weakened pile clusters at Detroit Edison's new 1500-ft coal loading dock at River Rouge, Mich (see illustration).

There are 26 clusters spaced approximately 50 ft apart, each made up of 15 piles. Twenty-four rope sling assemblies of 1½-in. rope, equipped with turnbuckles to take up slack, link the clusters. In addition, 12 special assemblies are anchored ashore and looped over every other pile. This has greatly strengthened the docks, it is reported.

## Mg-Si-Aluminum Alloy Developed for Busbars

(McGraw-Hill World News) An aluminum alloy for the manufacture of busbars has been developed by Northern Aluminum Company, Ltd, Birmingham, England. It is claimed to combine strength with lightness and high current-carrying capacity.

Known as Noral D50S, the alloy's physical properties reportedly enable it, with the size increase necessary to compensate for its lower electrical conductivity compared with copper, to be used in busbars which are mechanically, as well as electrically, equivalent to their copper counterparts. Minimum ultimate tensile strength of the alloy is 13 tons per sq in. and electrical resistance is 3.133 microhms per cm at 20 C. Lower electrical conductivity is due to its being a heat-treated magnesium-silicide alloy of aluminum, the company says. Addition of any element to pure aluminum necessarily lends to a reduction of electrical conductivity.

The alloy is available in the form of extruded sections and can be made in the form of plate when large rectangular bars are required.

## Southern Electric Corp Occupies New Office

Southern Electric Corp, Chattanooga, Tenn., is now occupying its new office—a modern, air-conditioned two-story building with 12,600 sq ft of floor space. The structure has a red brick exterior, wide thermopane windows, aluminum mullions and trim, black granite entrance facade and green marble foyer.

This office building adjoins the main plant in which aluminum and copper transmission and distribution line conductors and Compresto type service drop cables are produced.

## Ryerson Adds to N. J. Plant for Steel, Aluminum Service

A 50% increase in plant capacity provides approximately 355,000 sq ft of space at the steel and aluminum plant of Joseph T. Ryerson & Son, Inc, in Jersey City, N. J.

The new stainless steel sheath building will be used mainly for warehousing structural, reinforcing and sheet steel. In addition, here will be carried stocks of Reynolds aluminum which Ryerson is now selling in the area served by its New Jersey plant.

## U. S. Aluminum Production

Primary aluminum output in the U. S. during August was 92,406 tons, a decrease of more than 59,000 tons below July, according to the Aluminum Association, New York. The huge drop resulted from the United Steelworkers nine-day strike at the Aluminum Co of America and Reynolds Metals Co plants. Total production for the first eight months of 1956 reached 1,104,334 tons compared to 1,026,075 tons for the same period last year.

## *M&M BRIEFS*

**Porcelain Insulator Corp,** Lima, N. Y., has developed a porcelain cable separator for midspan service taps. This unit will accommodate up to 2/0 triplex cable.

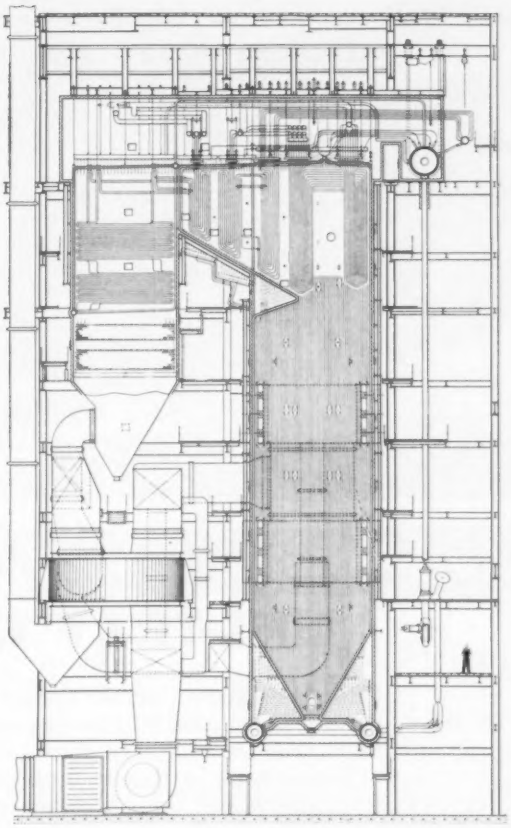
**Aerojet-General Corp.** Azusa, Calif., has formed a subsidiary to develop and produce nuclear reactors. Called Aerojet-General Nucleonics, the corporation will be under direction of Dr. Arthur T. Biehl and Robert Mainhardt.

(*More M&M on page* 59)

# SCHUYLKILL STATION

## Philadelphia Electric Company

# C-E controlled circulation boilers



The C-E Unit shown above is presently under construction for the Schuylkill Station of the Philadelphia Electric Company, Philadelphia, Pa.

The boiler is designed to serve a 175,000 kw turbine-generator operating at a throttle pressure of 2400 psig with a primary steam temperature of 1050 F, reheated to 1000 F.

It is of the controlled-circulation, radiant reheat type with a separated furnace arrangement. Secondary superheater surface is at the outlet of one furnace and reheater surface at the outlet of the other. Primary superheater sections and economizer surface follow both the secondary superheater and reheater surfaces. Regenerative air heaters follow the economizer surfaces. The section shown above is taken through the superheater furnace.

The unit is oil fired and uses tilting, tangential burners. It is arranged for future use of coal and/or gas as required. B-960

C-E

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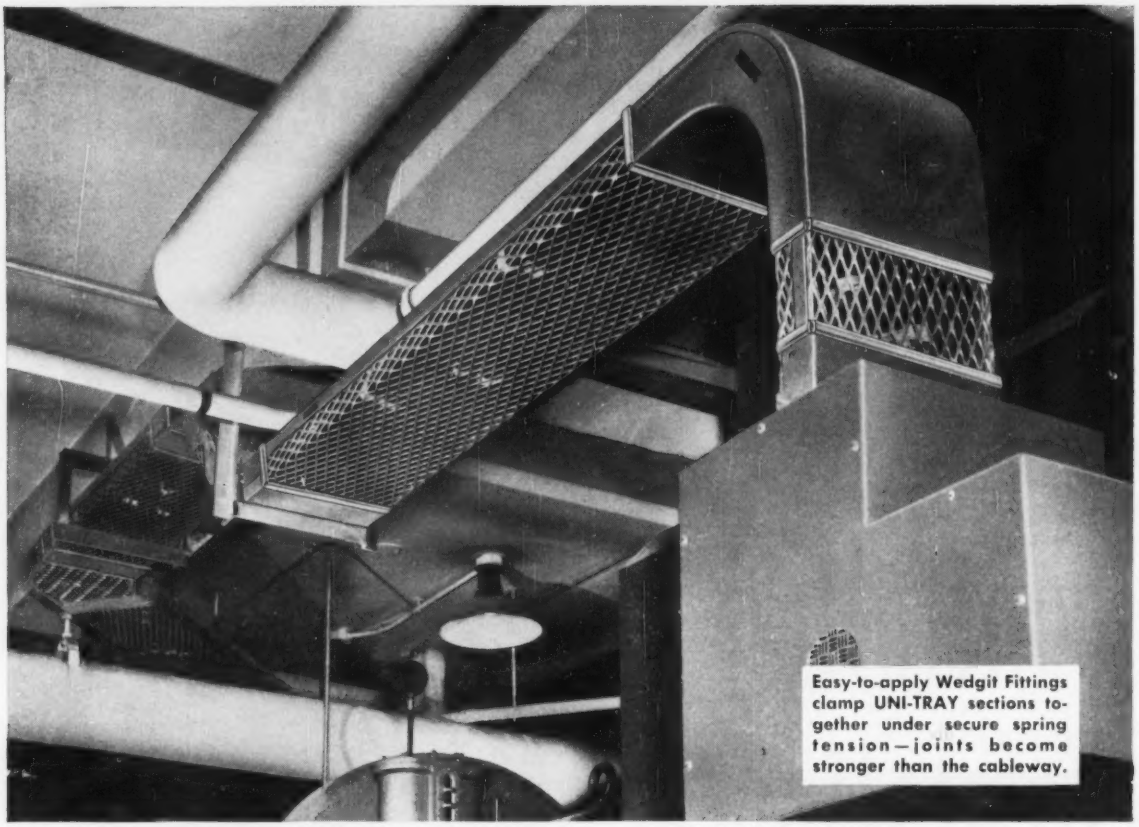


Easy-to-apply Wedgit Fittings clamp UNI-TRAY sections together under secure spring tension—joints become stronger than the cableway.

## Lower installation costs with an improved

# UNI-TRAY Cable-way System

With Delta-Star's UNI-TRAY Cable-ways you reduce installation time up to 40%—substantially cutting cableway costs. Simply position the trays, then tap in Wedgit Fittings to connect sections. No bolts, pins or hinges to fit or tighten. UNI-TRAY Cable-way joints are assembled four times faster than with other type fittings.

Strong, lightweight expanded metal sections provide ventilation necessary for high current rating of cables—prevent collection of water and dirt. Continuous Wedgit contact areas provide excellent electrical contact for ground currents.

UNI-TRAY sections are available in hot-dip galvanized steel, with aluminum Wedgit fittings. Aluminum sections also available. A wide variety of shapes and sizes meet specific requirements.

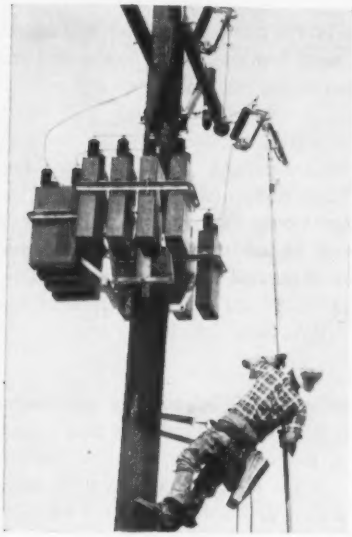
For complete facts, write for UNI-TRAY Publication No. 68—or see your nearby Delta-Star representative.

**DELTA-STAR ELECTRIC DIVISION**

**H. K. PORTER COMPANY, INC.**

**2437 Fulton Street · Chicago 12, Illinois · District offices in principal cities**

# S&C Electric Demonstrates 'Loadbuster'



A portable loadbreak tool, known as "Loadbuster," reportedly converts disconnect switches and cutouts into load interrupters. This recent development by S & C Electric Co of Chicago has a metal case for transportation on utility line trucks. It is said to provide arc-free interruption at any distribution system voltage through 14,400 v; it will break all load currents through 400 amp.

The device was demonstrated recently for a number of Middle Atlantic utility representatives. Line equipment used included a 600-amp, 15-kv convertible load break switch, a 100-amp, 15-kv fused cutout, and a tool-operated switch (under development). Each device was operated by a "hot stick" to open a 52-amp, 72% pf, 13.6-kv load. Each had to be closed immediately to extinguish the arc. But when the Loadbuster was used with a hot stick for the same operations, the arc was extinguished in the tool itself. The only visible indication of an electric circuit being opened with its resultant arc was a small puff of incandescent gases in a plastic chamber at the lower end of the loadbreak tool.

These tests were arranged by Electrical Testing Laboratories, Inc., of New York.

In actual operation (see illustration), the Loadbuster is hooked across the upper contacts of an S & C disconnect or cutout, which is then opened in the normal way. There's no external arc, contact burning, or danger to the operator. A twist of the stick disengages the tool, releasing it for immediate loadbreak service elsewhere. It can also be used to switch all pole-top capacitor tanks.

The tool can be used over and over again, and reportedly will withstand daily field use over a long period of time without requiring maintenance. Because it is portable, the manufacturer claims it can be readily inspected and kept in operating condition.

## Inaugurate Service on Transatlantic Cable

A new transatlantic telephone cable system linking New York, Ottawa and London (EW, Dec. 27, 1954, p. 110; July 4, 1955, p. 56; June 4, 1956, p. 59) was inaugurated and opened to public service in those three cities on September 25, 1956. The cables, the first physical voice link between North America and Europe, is jointly owned by American Telephone & Telegraph Co, the British Post Office, and Canadian Overseas Telecommunication Corp.

Cleo F. Craig, board chairman of AT & T, was the first to speak over the system, which is reported to have cost $42,000,000. He exchanged greetings with Dr. Charles Hill, head of the BPO, who spoke from London. He then spoke to George Marler, Canadian Minister of Transport, in Ottawa. The conversations, and several that followed, were played through a loud speaker. They had all the clarity and naturalness of a neighborhood call.

## Marcus Raises Prices

Marcus Transformer Co of Rahway, N. J., a manufacturer of dry-type and liquid-filled transformers, has made a general price increase of approximately 10% for its complete line. A spokesman for the company cited the steady rise of labor and materials costs as the reason for the increase.

## PLANT EXPANSIONS

• The new plant of Chromalox, Inc, at Murfreesboro, Tenn., a recently formed subsidiary of Edwin L. Wiegand Co, will reportedly add about 60,000 sq ft to the parent company's over-all manufacturing facilities. Chromalox will make band and tubular-type heating elements for electric heaters and small appliances.

• Added capacity for arc welding machine and electrode production is planned by Lincoln Electric Co, Cleveland, Ohio. An $8-million plan will boost capacity 60%.

• Scheduled for completion in July, 1957, the 2-story addition to Bailey Meter Co's plant at Wickliffe, Ohio, will add a reported 72,000 sq ft to the 165,000 sq ft, 1-story unit completed last year.

• Aluminum Co of America will be reportedly within hailing distance of the million-ton-a-year mark when additions to their plants at Point Comfort, Tex., and Warrick, Ind., are completed. The increases in production capacity will be 20,000 and 165,000 tons, respectively.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McGRAW-HILL PUBLISHING COMPANY, INC.
By JOHN J. COOKE, Secretary.

Sworn to and subscribed before me this 14th day of September, 1956.
[SEAL] JANET A. HARTWICK.
(My Commission expires March 30, 1957)

# BUSINESS OUTLOOK

**Electrical World**
OCTOBER 8, 1956

**A close look at business as it swings into the fourth quarter indicates that industrial production should rise enough in the next few months to make this the best quarter of the year.** More than that, it will be the best quarter of any year.

The Federal Reserve Board's index of industrial production will probably average out at 144 for the October-to-December period. That's a large jump over last quarters 139, which, of course, was abnormally depressed by the steel strike. And it's a substantial improvement over the average of 142 made in the first two quarters. **The year-end boost in industrial production should develop because strong demand is shaping up in several sectors of the economy.** We have already mentioned the continuing demand for capital equipment disclosed by a recent Commerce-SEC survey. (EW, Sept. 24, 1956.)

• • •

**The individual consumer will also play a major role in stimulating production over the months ahead.** Personal income has risen every month this year except July, when the steel strike lowered it almost microscopically. And so far this year, consumers have been spending freely. In the first six months, total retail sales ran 4% above last year in spite of the fact that auto sales were off 5%. In May retail sales reached an all-time record monthly rate.

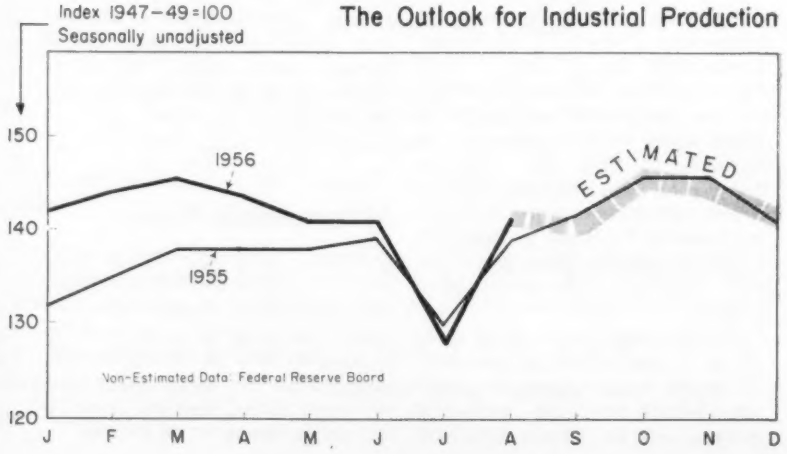
**Ordinarily, retail sales pick up sharply in the fall.** Since the consumer is well-fixed financially and has already showed that he is in a mood to buy, it is almost certain that the Christmas season coming on will be a good one.

• • •

The continued strength in the consumer household and apparel markets should keep production in these areas high. **On top of this, a big boost to total production may come from autos.** The new models are due in a few weeks, and the designs will be radically different. If they sell, production will probably swing up to a fourth-quarter level of 1.7 million from 1.0 million in the third quarter. And chances of cars selling are strengthened by the fact that people who bought on credit before 1955 are by now generally free to take on installment debt again.

**The demand now taking shape is likely to push the industrial production index a few notches higher during the first quarter of 1957.** Beyond that the terrain is less clear. But, as yet, there is no convincing reason to expect a let-down.

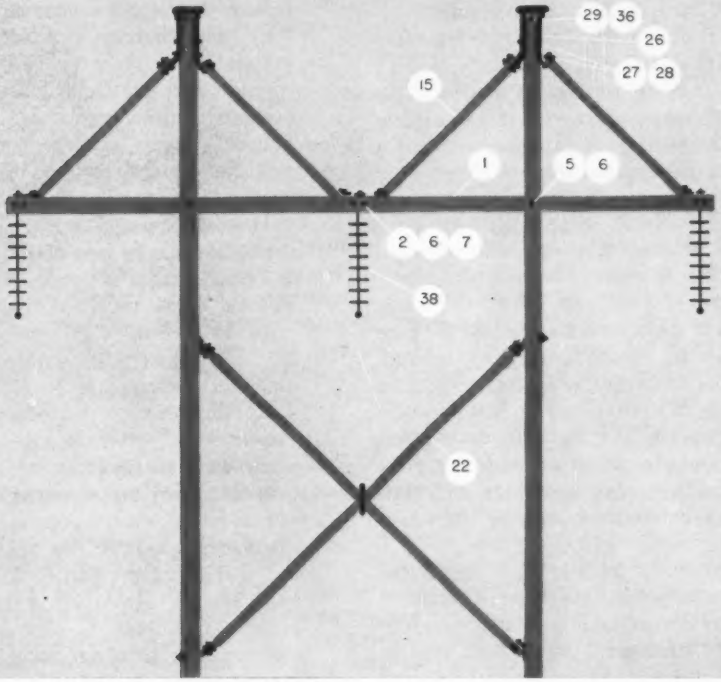
The Outlook for Industrial Production



## TANGENT W/BRACES NO. 702

**H-FRAME STRUCTURE, DOUBLE PLANK CROSSARMS WITH METAL SPACERS, POLE TOP STATIC WIRE SUPPORTS, AND WOOD CROSS BRACES DESIGNED FOR 69 TO 154 KV CONSTRUCTION**

| DRG. REF. # | QUANTITY | DESCRIPTION | DRG. REF. # | QUANTITY | DESCRIPTION |
|---|---|---|---|---|---|
| 792 | 2 | Pole | 15 | 4 | Vee brace 3⅜" x 4⅜" cross section |
| 1 | 2 | Crossarm | 22 | 1 set | Cross brace w/fittings, clamp, ⅞" pole bolts and curved washers |
| 2 | 3 | Steel spacer fitting w/mounting bolts | 26 | 2 | Static wire support |
| 5 | 2 | Stud bolt ⅞" w/washer nuts | 27 | 4 | Machine bolt ¾" |
| 6 | 8 | MF locknut ⅞" | 28 | 4 | MF locknut ¾" |
| 7 | 1 | Bent stud bolt ⅞" x 8" w/2 sq. nuts | 29 | 2 | Clevis |
| 7 | 2 | Bent bolt ⅞" x 5½" w/sq. nut | 36 | 2 | Suspension clamp for static wire |
| | | | 38 | As required | Suspension insulators and fittings |

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## IN THE INDUSTRY

# Protect Hydro Turbine Manufacturers

Over the past few years the manufacturers of hydraulic turbines and related equipment have been fighting a persistent and sometimes lonely fight against government purchase of foreign equipment. Occasionally other segments of the industry have joined in, but this has usually followed award of contracts for specific items affecting these segments.

A brand new book, "What The Tariff Means to American Industries" (Harper & Brothers, $5) by Percy W. Bidwell, helps to explain the concern of the turbine makers. The book also undertakes to explain why electrical manufacturers in general are not greatly affected by foreign imports.

### Manufacturers Seek to Protect Market

In the chapter dealing exclusively with electrical manufacturers, Bidwell makes this point:

"A small group of American firms have made large investments in specialized facilities for the production of hydroelectric equipment of giant capacity. The market for this equipment, which has never been extensive, is now seen to have only limited possibilities for future expansion. This fact is fundamental in explaining the manufacturers' strong protests against federal purchases of foreign equipment and their demand for strict enforcement of Buy American policies."

The author accepts, at least in part, one of the key arguments for supporting the domestic industry. That is the industry is essential in wartime to produce and repair needed equipment. As Bidwell puts it, "On defense grounds it would seem prudent policy to maintain in this country minimum facilities for the production and repair of hydroelectric equipment." Along this line, Bidwell favors amendment of the Buy American Act so as to apply only when security interests are involved.

### Book Presents Balanced Picture

Industry men who have read parts of this book believe it presents a generally balanced picture of the effects of foreign trade on electrical manufacturing and seven other industries. The publication is sponsored by the Council on Foreign Relations, a non-profit institution devoted to the study of international aspects of American political, economic, and strategic problems. As an organization, it takes no stand, expressed or implied, on American policy.

However, there is a real question as to whether the book meets its own objective of discussing tariffs and foreign trade as purely local issues. In the study directed at electrical manufacturing, the author is prone to look upon this vast industry in a general way, rather than at its hundreds of components. An order for foreign-made insulators, for instance, may have little effect on the industry as a whole. However, it could represent a considerable order for a single insulator producer.

Utilities will be interested in Bidwell's explanation as to why electric companies rely exclusively on the domestic industry for their equipment. He says this is due in large part to force of habit, intimate acquaintance, and reliance on domestic manufacturers. The utilities, he says, know they can rely on the domestic firms for technical services and for prompt repairs in case of breakdown. These considerations, taken all together, have outweighed possible savings from purchasing foreign machines.

## TECHNICAL NOTES

**Pneumatic hammers stop shaking** their operators when built with a recoil system resembling those used in rapid-fire guns.

**Outdoor power plant construction** demands weather-conscious scheduling.

**Epoxy resin is hard to machine,** generally requiring cutting tools of tungsten carbide or equivalent. But forms for molding it can be of ordinary metals because curing temperature is about 160C.

**Nearly 20% of electrical work injuries** reported in California in 1954 were attributed to damaged, defective, or insufficient insulation and 10% to inadequate maintenance. Other damaged parts, improper guarding of energized parts, and unapproved equipment were blamed for another 20%. But 24% occurred where there was no unsafe condition.

**Aluminum and zirconium** can be used to alloy or dilute materials for nuclear fuel elements because of their relatively low neutron-capture cross section.

**Lightning arrester voltage ratings** must be selected between 80 and 100% of system voltage for systems grounded through impedances or solidly grounded at only a few points.

# TVA's Net Revenues Climb to $54 Million

## Authority's financial statements for fiscal 1956 show net revenues up $6 million, gross power revenues up to $222 million from $188 million

Net revenues of $53.9 million were obtained from the sale of Tennessee Valley Authority power during the fiscal year ended last June 30 as compared with $47.9 million in the 1955 fiscal year, TVA has announced.

In its financial statements for the last fiscal year, TVA said total power operating revenues were $221,642,000, compared with operating revenues of $188,163,000 during the previous year.

The net operating revenues represented a return earned on the average investment in power facilities of 3.9%. Average investment in power facilities for the year was $1,380,000,000. The return for the 1955 fiscal year was 4.2% and the average return for the 23 years of TVA operations is 4%.

TVA's financial statements showed that the net expense of all non-power programs was $7,325,687, an increase of $977,675 over the previous year. Such operations include flood control, navigation, fertilizer and munitions development, and development of agriculture, forest and other resources.

Total TVA fixed assets less accumulated depreciation at the close of the year were $1,833,000,000, compared to $1,812,000,000 on June 30, 1955. In addition to the investment in direct power facilities, these included investment in multiple-use dams, chemical and general plant, construction in progress and investigations for future projects.

The fertilizer and munitions development program was carried on at a net expense of $1,127,746, compared to a net income of $7,680 during the 1955 fiscal year. TVA operates its Muscle Shoals chemical plants for the manufacture of products for agricultural and military purposes. Sales of fertilizer materials are not on a commercial basis, but are made to organizations collaborating in an educational program aimed at bringing about increased soil fertility through improved farming practices.

During the 1956 fiscal year, the generating capacity of TVA's power system grew from 7,809,985 kw to 9,279,485 kw. No units have gone into commercial operation since the close of the year.

Of total sales of 53.8 billion kwhr during the year, 30.5 billion were required by federal defense agencies, chiefly the Atomic Energy Commission. Of the total revenues of $221 million from these sales, $125 million were received from federal agencies.

Revenue from municipalities and cooperatives, distributors of TVA power, amounted to $65.9 million, up $7.7 million from 1955. Revenues from industries which purchase large amounts of power directly from TVA were $27.8 million, an increase of about $4 million over 1955. The municipal and cooperative distributors bought 15.5 billion kwhr, and the directly served industries purchased 7.2 billion kwhr.

Of the total revenues of $221.6 million, $109.6 million were spent for operating and maintaining the generating plants, and for power obtained from other systems. Twenty million dollars were needed to meet other expenses including transmission, general administration and payments to states and counties in lieu of taxes, and $38 million was provided for depreciation.

TVA paid $59 million into the U. S. treasury from power proceeds during the fiscal year. Of this, $45 million were on account of appropriated money invested in the power system and $14 million represented final payment in the redemption of a $65 million bond issue, the proceeds from which have been invested in the system.

TVA is required to pay from power proceeds the equivalent of appropriations invested in power facilities over a period of 40 years after the year in which the facilities go into commercial operation. The 1956 payments brought the total to $210,131,519.

## FINANCIAL & RATE BRIEFS

**General Public Utilities Corp** will pay November 15 a quarterly common stock dividend of 47½¢ a share as compared with 45¢ in the previous quarters of which 5¢ in each quarter was designated as a special.

**Long Island Lighting Co** is offering to its stockholders 180,000 shares of 4.40% preferred stock on the basis of one new share for each 38 common shares owned of record Sept. 28 at $100 a share. Preferred stock is redeemable from $104.50 until Sept. 30, 1959 to $101 after Sept. 30, 1966. The new preferred is convertible into common at $23.07 a share until Sept. 30, 1966.

**Nantahala Power & Light Co** has asked North Carolina Public Utilities Commission approval to charge a customer a $2 reconnection fee plus 15¢ a mile for the trip between his place and the company office to have service restored.

**Commonwealth Edison Co** is planning to sell 400,000 shares of non-convertible $100 par preferred stock to the public through an investment banking group headed by First Boston Corp and Glore, Forgan & Co. If sold, it will be the utility's first issue of non-convertible preferred stock.

Illinois Commerce Commission has ordered **Central Illinois Public Service Co** to reduce by $1.1 million a year its rates to CIP's 220,000 customers.

# Future Financing

### Investors Are Buying

Underwriters found a level at which investors are willing to buy utility issues. In mid-September a plateau was reached in the rising trend of cost of debt money. To illustrate: Early in September an issue rated Aa sold on a 4.20% yield, a few days later one came to market on a 4.17% basis and by the month's end a similar bond sold on a 4.01% basis. The above does not indicate the future of interest rates for there is a heavy volume of financing to come.

### Issues Being Switched

While interest rates were climbing in August and early September, a half-dozen utilities decided to postpone their debt financing from the fourth quarter of 1956 to early 1957. In all, issues totaling $105 million have been deferred to next year.

### Why Postponements?

Postponements in the industrial financing have been due not only to "unsettled money market conditions," but also to the fact that investors are demanding a 10-year non-call feature in the indenture.

### Municipal Financing Up

Municipal financing is also picking up—several deferred issues have been rescheduled for October.

### Due Diligence Meetings

October 9, Carolina Power & Light Co; October 17, Central Illinois Public Service Co; October 26, Ohio Power Co; and November 8, Public Service Electric & Gas Co.

(Furnished by the Irving Trust Co from the Financing Calendar)

| DATE | COMPANY | Amount of Offering (Millions) DEBT | EQUITY |
|---|---|---|---|
| OCT. 8 | Southern Bell Telephone & Telegraph | $60.0-C | 5 |
| 8 | Port of Portland, Ore | 147.0-C | |
| 9 | California Electric Power | 8.0-C | |
| 10 | Seaboard Finance | 15.0-N | |
| 10 | Texas Eastern Transmission | | 15.0-N Pfd |
| 11 | Blackstone Valley Gas & Electric | | 2.5-C Pfd |
| 16 | Carolina Power & Light | | 13.0-N COM |
| 17 | Mass. Highway | 58.0-C | |
| 23 | Consolidated Edison | 40.0-C | |
| 23 | Central Illinois Public Service | | 5.7-C |
| 25 | Ohio Thoroughfare | 25.0-C | |
| 30 | Ohio Power | 28.0-C | 6.0-C Pfd |
| 30 | Greenwich-Killingly Expressway | 75.0-C | |
| OCT. No Date | Alabama Gas | 7.0-P | |
| | Johns-Manville | | 36.0-N-rt COM |
| | Philadelphia, Pa | 50.0-C | |
| | Garden State Parkway | 25.0-C | |
| | Southern New England Telephone | | 20.4- -rt COM |
| | Curtis Publishing | 24.5- -R | |
| | Commonwealth Edison | | 40.0-N Pfd |
| NOV. 14 | Public Service Electric & Gas | 50.0-C | |
| NOV. No Date | Transcontinental Gas Pipe Line | 20.0-P | |
| | Sinclair Oil | 165-0-N-cv-rt | |
| DEC. 3 | U. S. Governments | 9,100.0- -R | |
| 4 | Michigan Bell Telephone | 30.0-C | |
| 4 | Public Service Electric & Gas | | 35.0-N COM |
| DEC. No Date | Massachusetts Port Authority | 115.0-C-R | |
| | Appalachian Electric Power | 24.0-C | |
| | Delaware Power & Light | | 6/8.0-C Pfd |
| | Texas Eastern Transmission | 40.0-N | |
| 4th Quarter of 1956 (Month not indicated) | Otter Tail Power | 5.0-N | |
| | Northern Natural Gas | 20.0-N | |
| | Philadelphia Electric | 30.0-C | |
| | U. S. Governments | 3,000.0* | |
| | Central Vermont Public Service | 1.0-N | |
| | American Louisiana Pipeline | | 15.0-C Pfd |
| | Texas Gas Transmission | 28/30.0 | |
| | Portland General Electric | 16.0-P | |
| | Kansas Nebraska Natural Gas | 5.5-P | |
| | U. S. Rubber | 52/60.0- -cv-rt | |
| | Dade County, Florida | 34.5-C | |
| | City of Dallas | 40.7 | |
| | Arizona Public Service | 8.0-P | |
| | North Carolina State School | 25.0 | |
| | El Paso Natural Gas | 30.0-P | |
| | J. P. Stevens | 30.0-N | |
| | Southern Nevada Power | 7.0-C | |
| | National Bank of Detroit | | 14.0- -rt COM |
| | New York State Thruway | 50.0-C | |
| | Public Housing Authority | 125.0-C | |
| | Ohio Thoroughfare Revenue | 50.0-C | |
| | Sacramento Utility District | 85.0 | |
| | Grand River Dam Auth., Okla | 27.0 | |
| | Hetch Hetchy, Calif | 54.0 | |
| | Mississippi Valley Gas | 1.5/2.0-P | |
| | Florida State Turnpike Auth | 185.0-N | |
| | California Toll Bridge Bay | 180.0- | |
| JAN. 15 | Louisiana Power & Light | 18/20.0-C | |
| JAN. No Date | Long Island Lighting | 20/25.0-C | |
| | New England Power | 10.0-C | |
| | Metropolitan Edison | 10.0-C | |

Symbols: C—Competitive; N—Negotiated; P—Private; R—Refunding; cv—convertible; rt—Rights; Pfd—Preferred; COM—Common. *Estimated.

# GET THE SAME AMOUNT OF CONDUCTOR FOR TWO-THIRDS THE COST!

**If you're still buying copper instead of Kaiser Aluminum, your spending about 1½ times the money needed to do the job!**

## CHECK THESE FIGURES:

1000 feet of #6 copper weatherproof costs you $49.93.

1000 feet of #4 KW polyethylene costs you only $31.50.

That's a saving of $18.43 per 1000 feet!

Let Kaiser Aluminum show you how to take full advantage of the savings possible through the use of aluminum conductor.

For immediate attention, contact your nearest Kaiser Aluminum sales office or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc. *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

**COST COMPARISONS**
(Based on prices in effect 8/16/56.)

| ALUMINUM | | COPPER | |
|---|---|---|---|
| 1000 Feet | Price | 1000 Feet | Price |
| #4 solid PE (2/64") | $ 31.50 — | #6 solid DBWP* | $ 49.93 |
| #2 strand PE (3/64") | $ 50.00 — | #4 solid DBWP* | $ 73.28 |
| #1/0 strand PE (4/64") | $ 81.00 — | #2 strand DBWP* | $122.09 |
| #4/0 strand PE (4/64") | $161.00 — | #2/0 strand DBWP* | $239.22 |

Delivered price on quantities of 20,000 *lbs.* or more.

Point of shipment price on 30,000 *lbs.* or more. Freight adders extra.

*Hard drawn, Double Braid URC

# Kaiser Aluminum

**The nation's largest producer of aluminum weatherproof and triplex**

**Aluminum is the answer to Adequate Wiring**

***See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.***

WEATHERPROOF DUPLEX TRIPLEX QUADRUPLEX — NEOPRENE • POLYETHYLENE • "TWO-SHOT" • SOLID OR STRANDED AAC, ACSR OR AAAC (ALL ALUMINUM ALLOY CONDUCTOR)

ACSR ALL-ALUMINUM OR AAAC

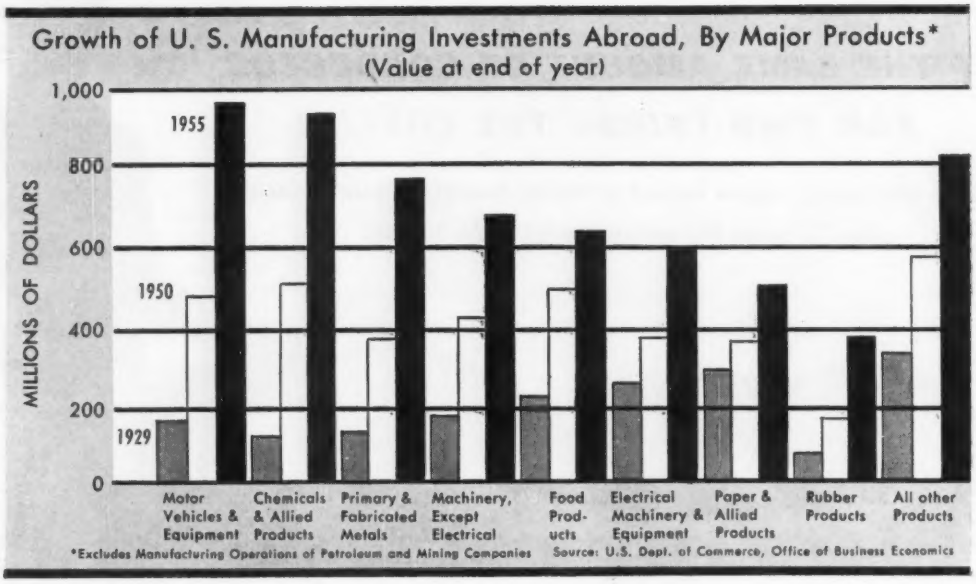
ARMORED SERVICE DROP

BUILDING WIRE & CABLE

SERVICE ENTRANCE CABLE

BUS CONDUCTORS — RECTANGULAR BAR; TUBULAR CONDUCTER; SOLID ROUND BAR

# STATISTICS




## Power Statistics . . .

| | | Latest Month | Preceding Month | Year Ago | Annual Change % |
|---|---|---|---|---|---|
| Capacity | July | 117.54 | 117.50 | 108.79 | 8.0 |
| Peak—Class 1 Systems (million kw) | July | 94.8 | 97.0 | 89.3 | 6.2 |
| Estimated Dec. '56 Peak (million kw) | July | 106.09 | 106.06 | 103.47 | 2.5 |
| Production—billion kwhr | July | 49.45 | 49.45 | 46.63 | 6.0 |
| Hydro | | 9.91 | 10.05 | 9.35 | 6.0 |
| Fuel | | 39.54 | 39.40 | 37.40 | 5.7 |
| Sales—billion kwhr | June | 44.53 | 44.18 | 40.10 | 11.0 |
| Residential | | 10.98 | 11.02 | 9.62 | 14.1 |
| Commercial | | 7.28 | 6.74 | 6.51 | 11.8 |
| Industrial | | 23.80 | 24.04 | 21.62 | 10.1 |
| Other | | 2.48 | 2.38 | 2.36 | 5.1 |
| Fuel Consumption | July | | | | |
| Coal—million tons | | 12.00 | 12.34 | 11.74 | 2.2 |
| Oil—million barrels | | 4.32 | 4.61 | 4.63 | −6.7 |
| Gas—billion cu. ft | | 136.97 | 127.04 | 127.62 | 7.3 |
| Net Income Class A & B Co's—$ million | July | 96.86 | 102.20 | 89.40 | 8.3 |
| Residential Customers—millions | 12 mos. ended June 30 | 44.99 | 44.87 | 43.76 | 2.8 |
| Revenue per kwhr | | 2.62¢ | 2.62¢ | 2.67¢ | −1.9 |
| Avg kwhr per customer | | 2,879 | 2,858 | 2,649 | 8.7 |
| Avg annual bill | | $75.43 | $74.88 | $70.73 | 6.6 |

## Business Statistics . . .

| | | | | | |
|---|---|---|---|---|---|
| Indexes: 1947–49 = 100 | | | | | |
| FRB Industrial Production | Aug. | 141 | 128 | 139 | 1.4 |
| ENR Construction Cost | Sept. | 147.8 | 146.0 | 141.0 | 4.8 |
| BLS Cost-of-living | Aug. | 116.8 | 117.0 | 114.5 | 2.0 |
| NEMA Sales | | | | | |
| Insulation materials | July | 117 | 156 | 117 | 0 |
| Electric appliances | | 111 | 106 | 98 | 13 3 |
| Wholesale prices | June | | | | |
| Motors and generators | | 132.3 | 132.1 | 120.8 | 9.5 |
| Transformers and regulators | | 138.2 | 137.5 | 127.3 | 8.6 |
| Switchgear and fuses | | 152.3 | 151.2 | 135.6 | 12.3 |
| GNP—annual rate—$ billion | 2nd Qtr. | 408.3 | 403.4 | 387.4 | 5.4 |

# HOW MUCH PUNCHING

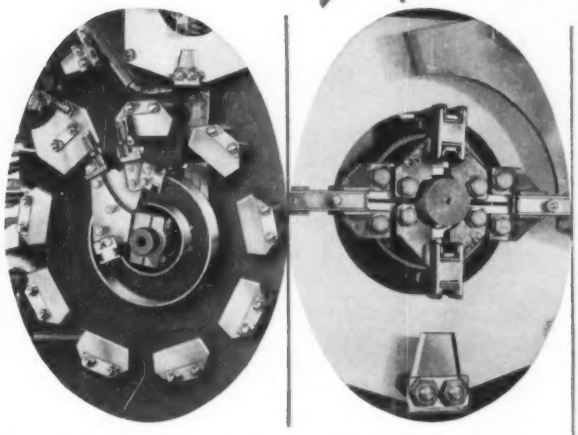
## CAN YOUR SYSTEM STAND?

(Utility System, that is)

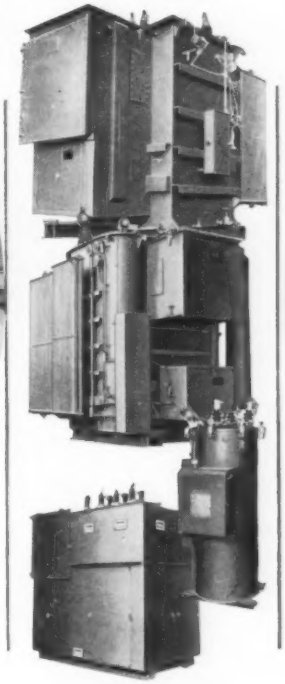
It's literally true that every time a switch is flicked, or a button punched, your system (utility) takes the brunt of it. Of course this adds up to greater power consumption which is desirable, but it also puts quite a strain on voltage regulation throughout your system.

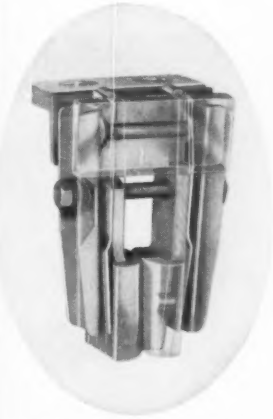
When power demand peaks and ebbs rapidly, be sure that your regulating points are manned by equipment that is able to take it and continue to operate efficiently, smoothly and dependably. In other words, install Moloney Load Tap Changing equipment because . . .

ME56-23



**Moloney's exclusive by-pass reactor principal—used for all Kva and voltage ratings—permits regulation of voltage *without* arcing at Tap Selector Switch (left) because *all* current interrupting duty is performed by Load Tranfer Switch (right). Arcing at Load Transfer Switch is minimized by a reactor in parallel with the Load Transfer Switch.**





**Contacts used for current interrupting duty are tipped with a high arc-resistant, copper-tungsten alloy to minimize arc deterioration and maintenance costs.**

**MOLONEY ELECTRIC COMPANY**

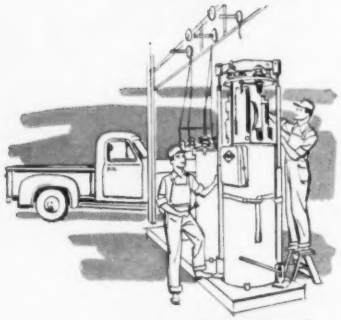
*Power Transformers • Distribution Transformers • Load Tap Changing Transformers*
*Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers*
*Industrial Dry Type Transformers • Capacitors • Transformers and Inductors for Electronics*

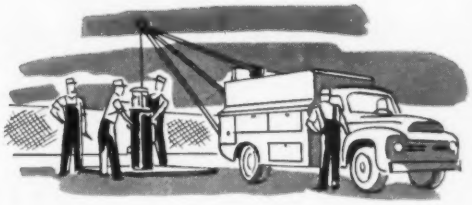
**SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA**

# How to Reduce Regulator Service Costs

## Compare

**Servicing Allis-Chalmers Regulators** **vs** **Servicing Other Regulators**





**1**—Drain oil from tank

**2**—Remove cover, bushings and control leads

**3**—Piecemeal untanking

LIVE BETTER ELECTRICALLY

### Unit Construction of Allis-Chalmers Regulators makes startling savings possible

A 2-man crew arrives in a pickup truck, switches the regulator off the line and sets up the hydraulic jack. In a matter of a few minutes the entire mechanism is lifted far enough out of the tank for inspection. Even the bushings remain in place.

There's no need for a large crew and expensive equipment to move regulator and service it.

This is just one of many savings using Allis-Chalmers regulators. For the complete story, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

# ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5143